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Original Articles

TREATMENT OF CLASS II, DIVISION 1 (ANGLE)

I. Occipital Anchorage

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SCOPE

THIS is the first of a series of papers dealing with the treatment of Class II, Division 1 cases of malocclusion. As the title indicates, this paper is concerned with occipital force and its purpose is twofold:

1. To discuss the use of occipital anchorage for the correction of the anteroposterior malrelationship of the dental arches in Class II, Division 1 cases.
2. To show some results obtained by this method and a cephalometric appraisal of the changes produced in the dentofacial complex.

INTRODUCTION

Occipital force is, of course, not new; and it is not original to suggest that it may be used in the treatment of Class II, Division 1. First introduced over a century ago in the form of a skullcap in combination with a chin cap, it was later used by Kingsley (1866) to retract and depress the maxillary anterior teeth. His apparatus consisted of "A frame covering the bicuspids and molars of the upper jaw with arms coming out of the corners of the mouth and extending along the cheeks to a point exactly opposite the center of pressure required within the mouth; a small wire passed in front of the incisors to keep them from

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springing forward and two elastic straps connected this frame with the skull-cap.''[15]

Many outstanding pioneer members of the dental profession, among them Guilford, Farrar, Goddard, Angle, and others, used this form of anchorage in the treatment of ''protrusion cases.''

Occipital force was used extensively by Calvin S. Case in the treatment of cases with blocked-out canines.[4]

Albin Oppenheim used the same force for the posterior movement of the maxillary teeth. A quotation from his paper, ''Biologic Orthodontic Therapy and Reality,'' published in 1936, reads: ''For the treatment of similar cases, which form a great portion of our practice-material and which deal with a forward wandering of the buccal teeth, especially the canines, and also in the treatment of Class II cases in which we carry the upper teeth backward rather than the lower teeth forward this procedure is, in my opinion, most recommendable.''[10]

More recently, some orthodontists have used occipital force not to move teeth but rather to reinforce dental anchorage.[13] It is also used today in the preparation of mandibular anchorage prior to the use of intermaxillary Class II elastics as advocated by Tweed[14] in the treatment of Class II, Division 1 cases of malocclusion.

From the above necessarily short and incomplete historical review, it may be seen that occipital anchorage has been in use in the practice of our specialty for over a century. Yet, we find that it has not been adopted generally and that today it is less popular with the orthodontic practitioner than it was before the turn of the century. The reason for this may be found in several factors, two of which are pertinent to this discussion. The first is the discomfort caused to the patients by the various early forms of occipital apparatus. The requirements for an efficient, simple, and comfortable occipital apparatus will become clearer when we come to discuss its construction for the individual patient. The second and most important factor was the adoption by Angle of *intermaxillary force*. In 1889, Angle, discussing occipital anchorage, stated: ''The value of the occipital bandage, as a means of anchorage is, I believe, becoming more and more appreciated and is especially applicable in this class of cases. (Meaning maxillary protrusions.) I am using the appliance herein described in my sixteenth case, and I consider it much more satisfactory than any of the few devices which are described in our literature on this subject.''[1] It is interesting to compare the above statement with the one appearing in the seventh edition of Angle's book, *Malocclusion of the Teeth,* published in 1907. Again referring to occipital anchorage, he states: ''Notwithstanding the efficiency of this appliance, the present demands of orthodontia are best fulfilled in these cases (meaning maxillary protrusions) by the Baker form of intermaxillary anchorage, later to be considered, by means of which extraction is avoided and normal occlusion established instead of merely 'improved' occlusion as in the former plan of treatment. For this reason this appliance has been superseded in the author's practice, and though it may occasionally be used as auxiliary to intermaxillary anchorage, yet the necessity for its use will

become lessened as greater skill in the employment of intermaxillary anchorage is developed''[2]

The explanation for this change in Angle's attitude toward occipital anchorage, I believe, may be found in the fact that intermaxillary force fitted in much better with his changed views on diagnosis, classification, and treatment of malocclusion. Angle based his classification and treatment upon two hypotheses: (1) That the maxillary first permanent molar always erupts in the correct relationship to cranial anatomy, and (2) ''That the best balance, the best harmony, the best proportions of the mouth in its relations to the other features require that there shall be *the full complement of teeth,* and *that each tooth shall be made to occupy its normal position*—normal occlusion.''

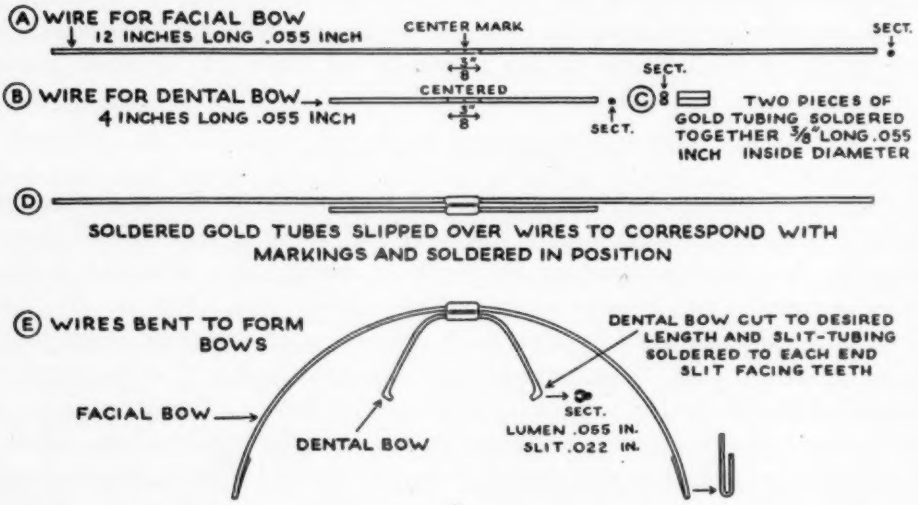
To move the maxillary molars posteriorly in treatment would not be consistent with these hypotheses and a force formerly employed to accomplish this posterior movement was, therefore, superseded by one consistent with his reasoning—intermaxillary force.

Today, when the validity of Angle's hypotheses—the constancy of the maxillary first permanent molar and that the best results can be obtained only if a full complement of teeth is retained—is being seriously questioned, a reevaluation of occipital force in the treatment of Class II, Division 1 should prove to be of more than academic interest.

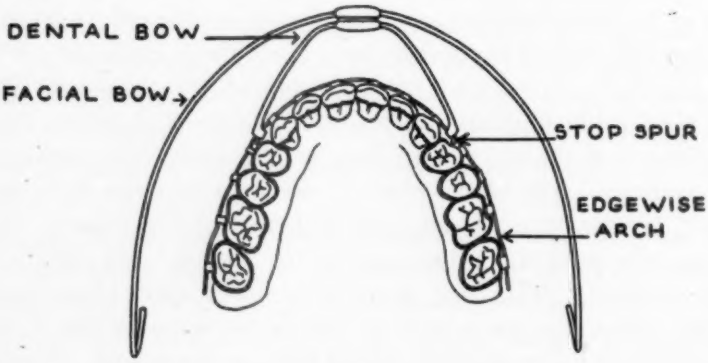
THE OCCIPITAL APPARATUS

With some minor modification, the headcap (Fig. 1, *A* and *B*) is similar to the one designed by Strang.[11] The occipital force is transmitted from the headcap to the edgewise arch on the teeth by means of a double bow hooked onto the headcap with elastic bands. This double bow (Fig. 1, *D*) follows the pattern of the one used by Case.[4] It consists of an outer or *facial bow* and an inner or *dental bow.* The headcap has been described in the literature. The construction of the double bow (Fig. 1, *C*) is as follows: Two lengths of round stainless steel wire 0.055 inch in diameter, one, one foot long and the other four inches long, are marked in the center by means of a file. Two additional marks, one on each side of the center mark, are made three-sixteenths of an inch from the center. Two pieces of round gold tubing 0.055 inch inside diameter and three-eighths of an inch long are soldered together along their length. The long wire is put through one of the tubes until the tube is centered on the wire and the ends of the tube correspond with the outside markings on the wire. By fluxing with steel soldering flux and using stainless steel solder, fasten the tube to the wire. Now put the short wire through the other tube, center it and solder in a similar manner. The short wire is now bent to form the dental bow and the outer wire is bent into a semicircle to form the facial bow. The length of the dental bow depends upon the site on the dental arch where the occipital force is to be applied. *With this form of occipital apparatus, this force can be applied to the molar, the premolar, or the canine area of the dental arch.* Its length is ascertained by trying the dental bow in the mouth. If the pressure is to be applied to the molars, the bow will be measured to those teeth. The length of the bow is decreased as we are to apply the pressure to the teeth anterior

A. *B.*



C.



D.

Fig. 1.—*A*, Headcap and occipital bow adjusted to patient; front view. *B*, Headcap and occipital bow adjusted to patient; profile view. *C*, Steps in construction of occipital bow. *D*, Occipital bow adjusted to the dental arch.

to them. To each end of the dental bow a piece of slit tubing is soldered with the slit facing the dental arch. The lumen of this tube is 0.055 inch in diameter and the slit is 0.022 inch wide. After finishing the tubing and smoothening the overhanging edges, it is again tried in the mouth by placing the small slit tubes on the edgewise arch. While in this position, the edgewise arch is marked for the location of stop spurs against which the slit tubes of the dental bow will rest when the force is transmitted to the teeth. After the dental bow is adjusted, the whole apparatus is removed from the mouth and the ends of the facial bow are bent upon themselves one and one-half inches from the end, to form hooks for the elastics. The surplus of these ends is cut off, leaving about three-eights of an inch. The two bows and soldering joints are finished and polished. In order to prevent the spreading of the slit tubing in the manipulation of the occipital apparatus by the patient, it is advisable to reinforce the lips of the tubing by means of solder after it has been ascertained that the dental bow will go readily in place over the edgewise arch. The force is transmitted to the teeth by means of elastics hooked onto the facial bow and the headcap. One elastic on each side is used at first and the force is increased by doubling and tripling these elastics.

The occipital apparatus as described has the following advantages: (1) It is sturdy, comfortable, and efficient. (2) The occipital force can be applied to any area of the dental arch. (3) By means of the dental bow any undesirable expansion in the premolar and molar region can be prevented. This expansion invariably follows the application of occipital force from individual right and left hooks to the intercanine segment of the edgewise arch. (4) The apparatus has proved efficient not only in the preparation and reinforcing of anchorage but also in the posterior movement of the maxillary arch or its lateral segments without recourse to intermaxillary elastics.

CASE REPORTS

The cases this paper deals with are part of a group characterized by the plan of treatment followed, rather than by the degree of malocclusion present. As stated above, the important feature of this treatment plan is the use of occipital force, applied directly to the maxillary arch for the correction of the anteroposterior malrelationship of the dental arches. No attempt was made to "prepare" anchorage in the mandibular arch and at no time have Class II intermaxillary elastics been used during active treatment. With the exception of the bilateral Class II molar relationship and the more or less marked facial involvement which stamps these cases as Class II, Division 1, all other attributes—the axial inclination of the mandibular incisors, the inclination of the mandible as related to the face and cranium, the extent of the overbite and overjet—were *not* determining factors in the plan of treatment. The cases were not selected according to their variations. They were taken at random in order to test the efficacy of occipital force as a corrective measure for arch malrelationship of Class II, Division 1 cases, regardless of their differences and variations.

Of the six cases selected for this presentation, three were treated in the mixed dentition and three were treated in the permanent dentition.

Method of Appraisement.—The results of treatment were appraised by the use of records obtained from (a) oriented plaster casts, (b) oriented facial photographs, and (c) oriented mandibular roentgenograms. These will have to be explained briefly.

Oriented Plaster Casts.—The casts are oriented to the Frankfort plane by

A.

B.

C.

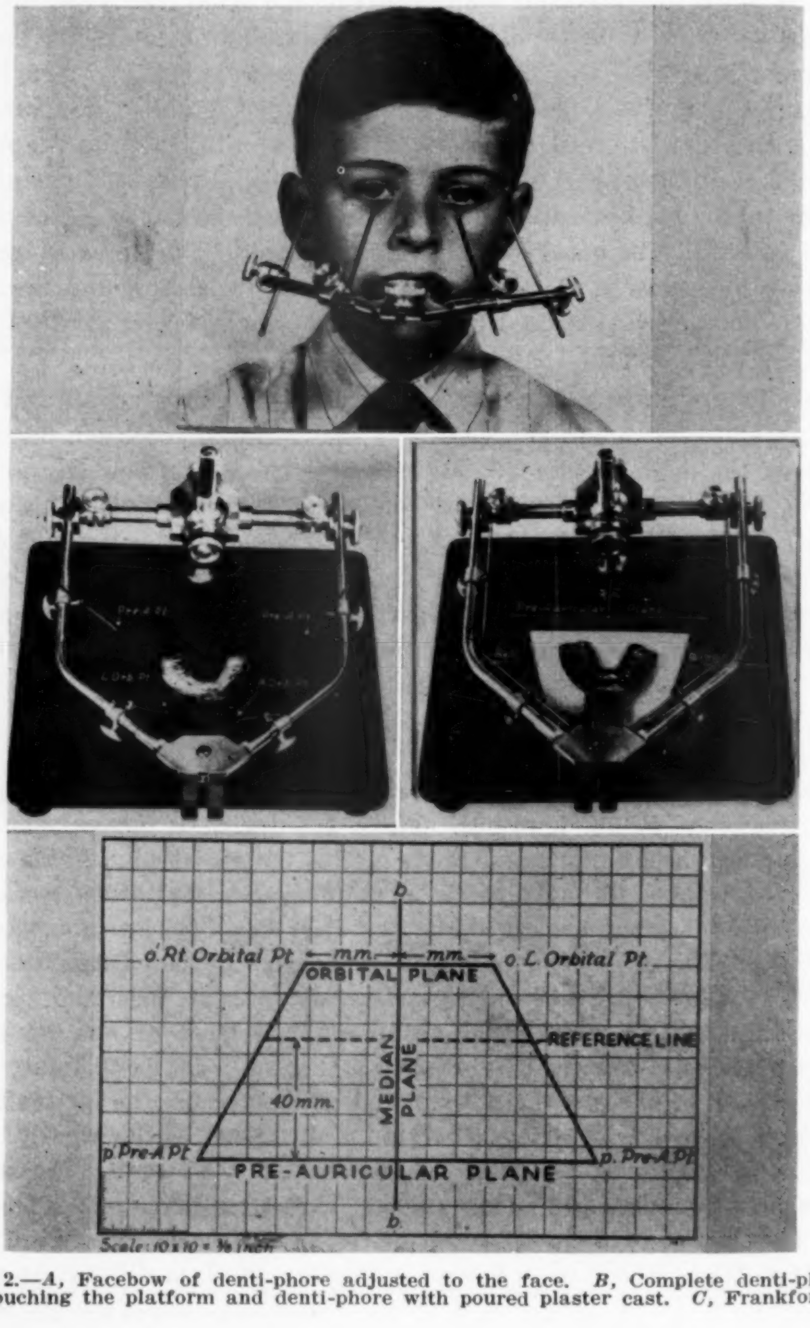


Fig. 2.—*A*, Facebow of denti-phore adjusted to the face. *B*, Complete denti-phore with pointers touching the platform and denti-phore with poured plaster cast. *C*, Frankfort quadrilateral.

means of the denti-phore,[5] an instrument adjusted on the face to the two orbital and two preauricular points (Fig. 2, *A*). By transferring these four points to graph paper and joining them, we obtain the ***Frankfort quadrilateral*** (Fig. 2, *B* and *C*). Some of the graphs to be shown are projections of the teeth upon this Frankfort quadrilateral. All changes in tooth position in an anteroposterior direction are measured from the base of this quadrilateral or ***preauricular plane***. All changes in a lateral direction are measured from the ***median plane*** which bisects the preauricular plane. Two mandibular casts are made with their bases parallel to the base of the maxillary cast. One of these mandibular casts is sectioned through the middle of the left central incisor tooth along a line parallel to the median plane. On this oriented sectioned mandibular cast, the ***crown axis*** of the incisor tooth is determined and prolonged until it cuts the base of the cast (Fig. 2, *D*). The angle formed is the ***incisor-axial angle***.[8] Since the base of this cast is parallel to the Frankfort plane, this angle is the angle that the crown axis of the mandibular incisor makes with the Frankfort plane.

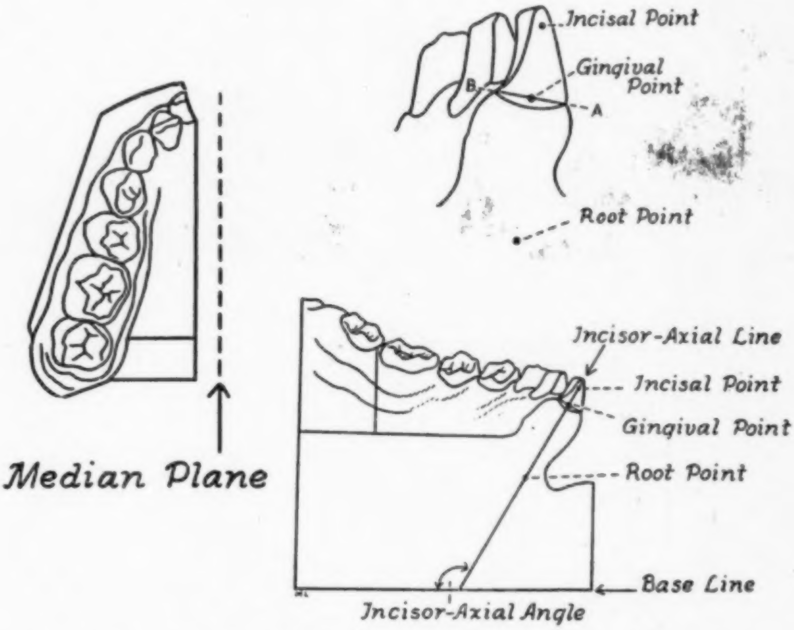


Fig. 2.—*D*, Steps in determining the incisor-axial angle.

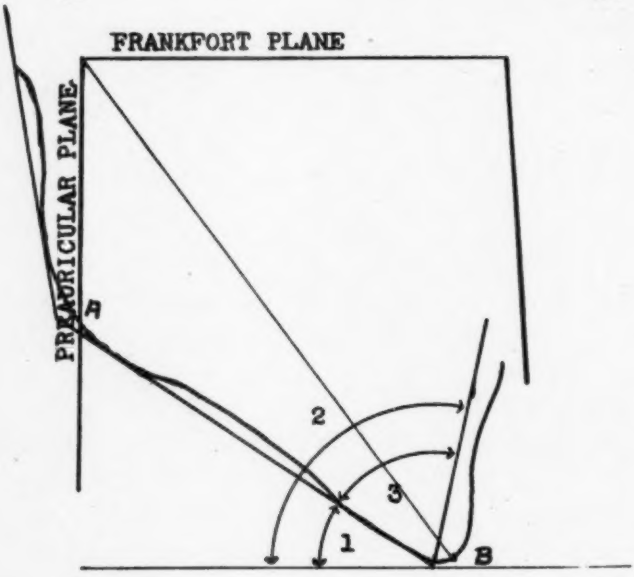
Oriented Facial Photographs.—Profile and front view photographs are obtained with the head of the patient positioned in the cephalo-phore[6] and oriented to the ***Frankfort, orbital,*** and ***median*** planes (Fig. 2, *E*).

Oriented Mandibular Roentgenograms.—The cephalo-phore is also used to position the head while taking the mandibular roentgenogram.[9] This roentgenogram is taken with the patient biting on a modeling compound block in which is imbedded a portion of a wire previously superimposed upon the incisor-axial line of the sectioned cast. The roentgen ray is directed perpendicular to the median plane of the cephalo-phore. By extending the line of the wire on the

roentgenogram until it intersects the lower border of the mandible, we get the crown axis of the incisor tooth (Fig. 2, *F*). The oriented mandibular roentgenogram is used to obtain certain important angles and angular relationships used in the construction of the sagittal diagram (Fig. 2, *G*).

E.

F.

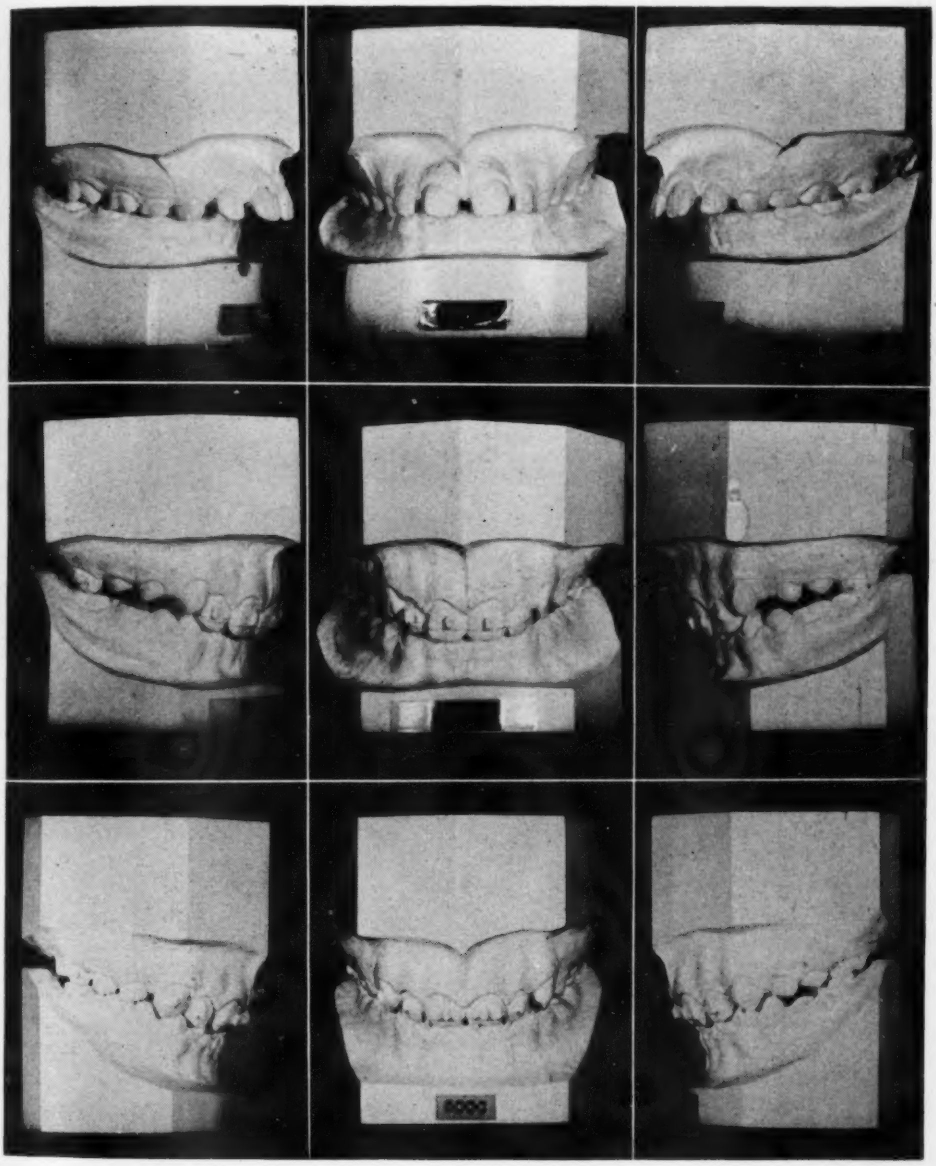


G.

Fig. 2.—*E*, Cephalo-phore in position for photograph. *F*, Oriented mandibular roentgenogram: *AB*, crown axis; *CD*, root axis; *AOC*, crown-root angle. *G*, Sagittal diagram. *1*, Frankfort-mandibular plane angle; *2*, incisor-axial angle; *3*, incisor-mandibular plane angle; *A*, gonion; *B*, gnathion.

TREATMENT IN THE MIXED DENTITION

The following three cases were treated in the mixed dentition. Only the changes produced in the first period of treatment which has to do with the correction of the anteroposterior malrelationship of the dental arches will be shown in the graphs.



A.

B.

C.

Fig. 3.—Case 600. *A*, Dental casts before treatment. *B*, Dental casts at end of occipital anchorage. *C*, Dental casts during retention showing erupting permanent teeth coming into occlusal contact.

CASE 600.—Age at the beginning of treatment, 8 years, 6 months. Fig. 3, *A* shows the dental casts before treatment. Fig. 4, *A* shows the front facial and profile photographs before treatment. Fig. 4, *C* shows the lateral jaw roentgenograms before treatment.

Mechanics Used.—The occipital apparatus was applied to the maxillary arch in the molar area. No mandibular appliance and no Class II intermaxillary elastics were used. The headcap was worn for twelve months.

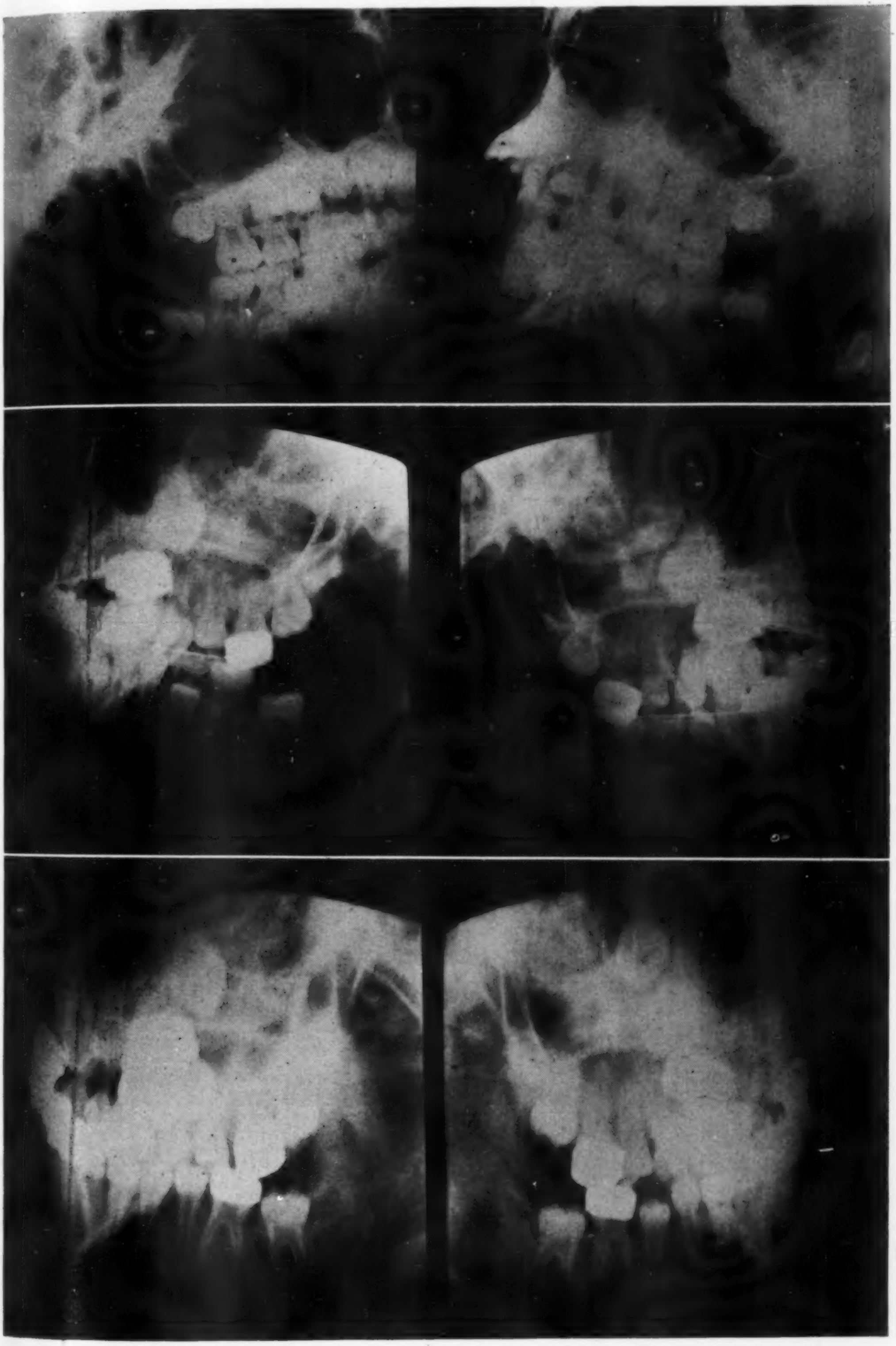
Analysis of Tooth Movement.—Fig. 3, *B* shows the dental casts of this case at the end of occipital anchorage. The Class II molar relationship has been overcorrected. The excessive overbite is still present and is being corrected in the second period of treatment.

A. B.

Fig. 4.—Case 600. *A*, Facial photographs before treatment. *B*, Facial photographs at end of occipital anchorage. *C*, Lateral jaw roentgenograms before treatment. *D*, Lateral jaw roentgenograms at end of occipital anchorage. *E*, Lateral jaw roentgenograms one year after end of occipital anchorage.

Fig. 4, *B* shows the front facial and profile photographs at the end of occipital anchorage. Fig. 4, *D* shows the lateral jaw roentgenograms at the end of occipital anchorage.

The projection of the teeth on the Frankfort plane before and after the use of occipital anchorage shows the following changes: (1) The *superposed*



C.

D.

E.

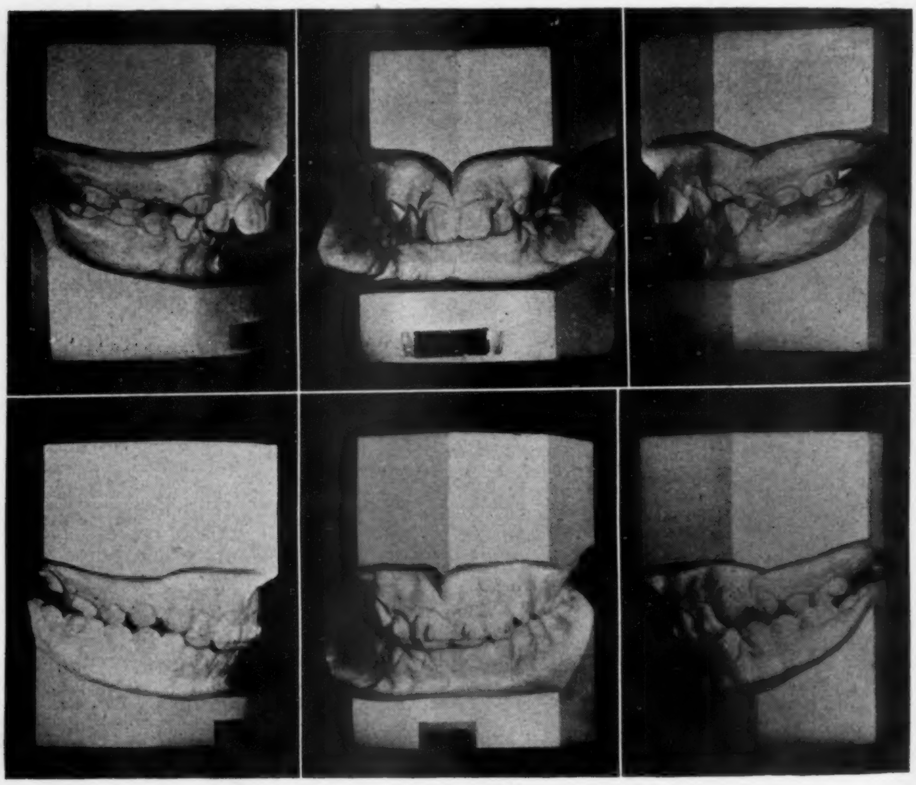
Fig. 4.—*C, D, E* (*For legend, see opposite page*).

maxillary diagrams (Fig. 9, *A*). (a) *From the median plane.*—The original bilateral symmetry has been maintained and is present at the end of treatment and there is no expansion of the arch. (b) *From the preauricular plane.*—The maxillary arch has been moved posteriorly the full distance. (c) Natural growth of the head is expressed in the larger *Frankfort quadrilateral.* (2) The *superposed mandibular diagrams* (Fig. 9, *B*). There is no appreciable change in the position of these teeth.

In this case we held the corrected anteroposterior arch relationship and Fig. 3, *C* shows the erupting permanent teeth coming into occlusal contact and the correction of the overbite.

Fig. 4, *E* shows the lateral jaw roentgenograms during retention, one year after the end of occipital anchorage.

A.



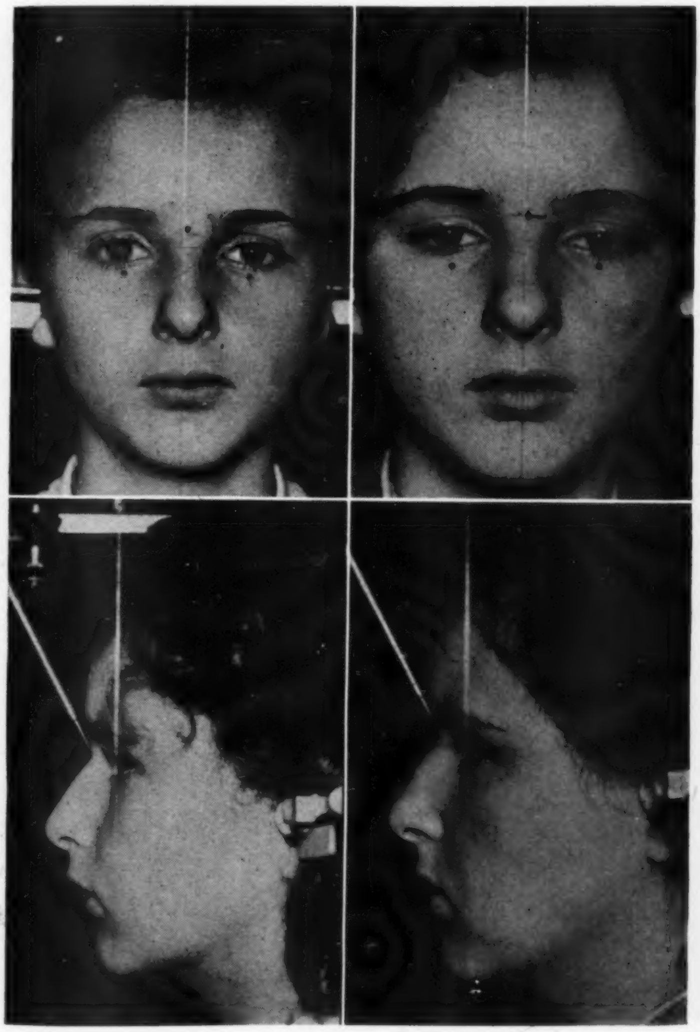
B.

Fig. 5.—Case 613. *A*, Dental casts before treatment. *B*, Dental casts at end of occipital anchorage.

Case 613.—Age at the beginning of treatment, 11 years. Fig. 5, *A* shows the dental casts before treatment. Fig. 6, *A* shows the front facial and profile photographs before treatment. Fig. 6, *C* shows the lateral jaw roentgenograms before treament.

Mechanics Used.—A maxillary edgewise appliance was used. Only the four permanent incisors and the first permanent molars were included in the

assemblage. The anterior part of the edgewise arch was rounded off. The occipital apparatus was applied to the maxillary arch in the molar area. No mandibular appliances and no Class II intermaxillary elastics were used. The headcap was worn for eleven months. The finishing stage of this case consisted of nothing more than holding the corrected anteroposterior relationship of the arches in order to allow the erupting permanent teeth to find their proper occlusal contact.

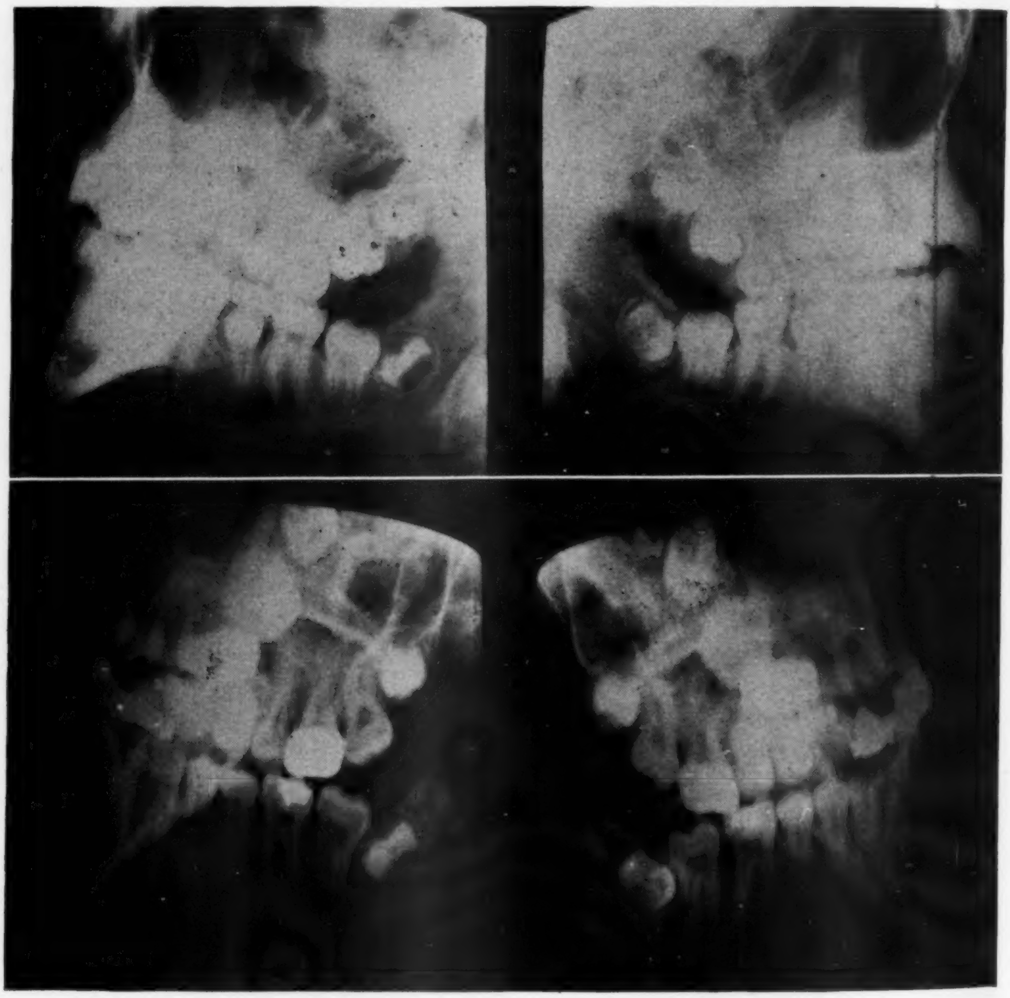


A. B.

Fig. 6.—Case 613. *A*, Facial photographs before treatment. *B*, Facial photographs at end of occipital anchorage.

Analysis of Tooth Movement.—Fig. 5, *B* shows the dental casts of this case at the end of occipital anchorage. The Class II molar relationship has been overcorrected. The overbite and overjet have also been corrected. Fig. 6, *B* shows the front facial and profile photographs at the end of occipital anchorage.

Graphs representing the projection of the teeth on the Frankfort plane before and after the use of occipital anchorage show the following changes: (1) The *superposed maxillary diagrams* (Fig. 9, *C*). (a) *From the median plane.*—The original bilateral symmetry has been maintained throughout treatment and is shown in the graph at the end of treatment. There is no expansion of the arch. (b) *From the preauricular plane.*—The maxillary arch has moved posteriorly. (c) Natural growth of the head is expressed by the increase in the size of the *Frankfort quadrilateral.*



C. *D.*

Fig. 6.—Case 613. *C*, Lateral jaw roentgenograms before treatment. *D*, Lateral jaw roentgenograms at end of occipital anchorage.

Fig. 6, *D* shows the lateral jaw roentgenograms at the end of occipital anchorage.

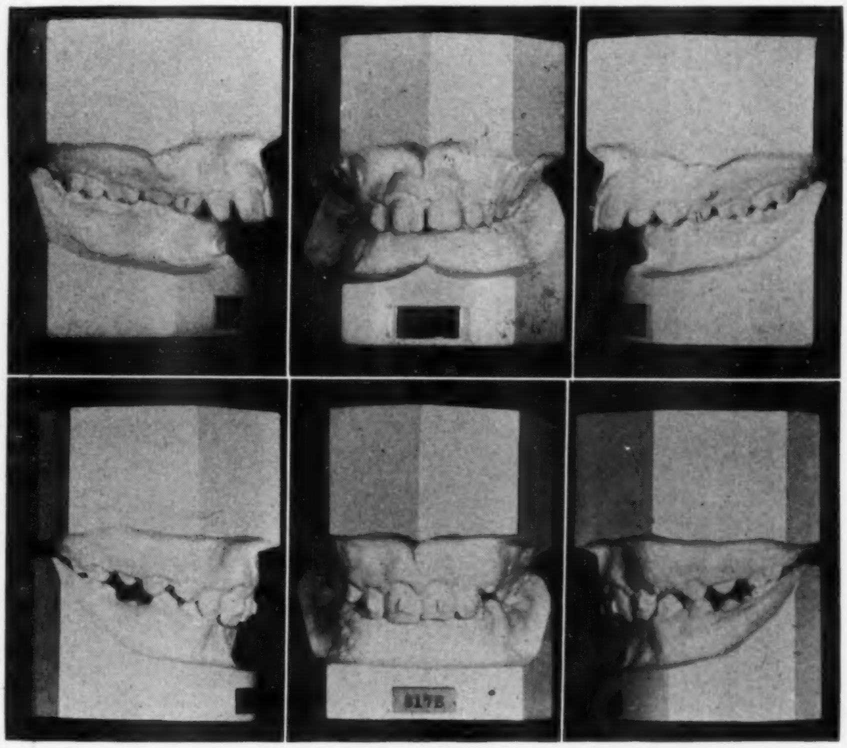
Case 617.—Age at the beginning of treatment, 10 years. This case was complicated by a very deep overbite and marked overjet. Fig. 7, *A* shows the

dental casts before treatment. Fig. 8, *A* shows the front facial and profile photographs before treatment. Fig. 8, *C* shows the lateral jaw roentgenograms before treatment.

Mechanics Used.—The occipital apparatus was applied to the maxillary arch in the molar area. No mandibular appliance and no Class II intermaxillary elastics were used. The headcap was worn for six months.

Analysis of Tooth Movement.—Fig. 7, *B* shows the dental casts of this case at the end of occipital anchorage. The Class II molar relationship has been overcorrected. The excessive overbite was still present and had to be corrected in the second period of treatment.

A.



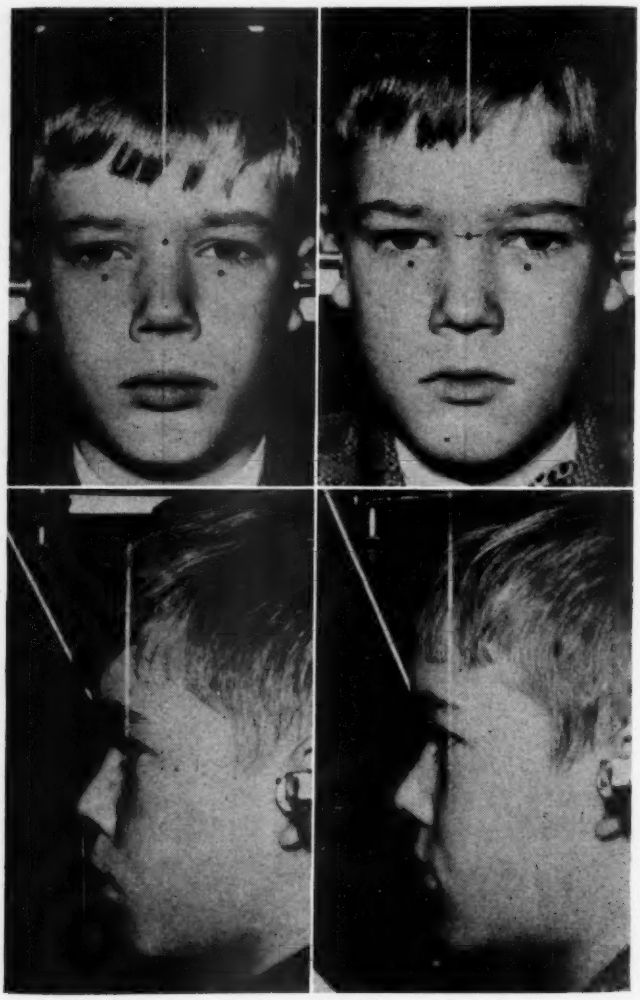
B.

Fig. 7.—Case 617. *A*, Dental casts before treatment. *B*, Dental casts at end of occipital anchorage.

Fig. 8, *B* shows the front facial and profile photographs at the end of occipital anchorage.

The projection of the teeth on the Frankfort plane before and after the use of occipital anchorage shows the following changes: (1) The *superposed maxillary diagrams* (Fig. 9, *E*). (a) *From the median plane.*—The lateral halves of the arch are symmetrical as compared with the asymmetry present at the beginning of treatment and there is no expansion of the arch. (b) *From the preauricular plane.*—The *superposed maxillary diagrams* show only slight distal

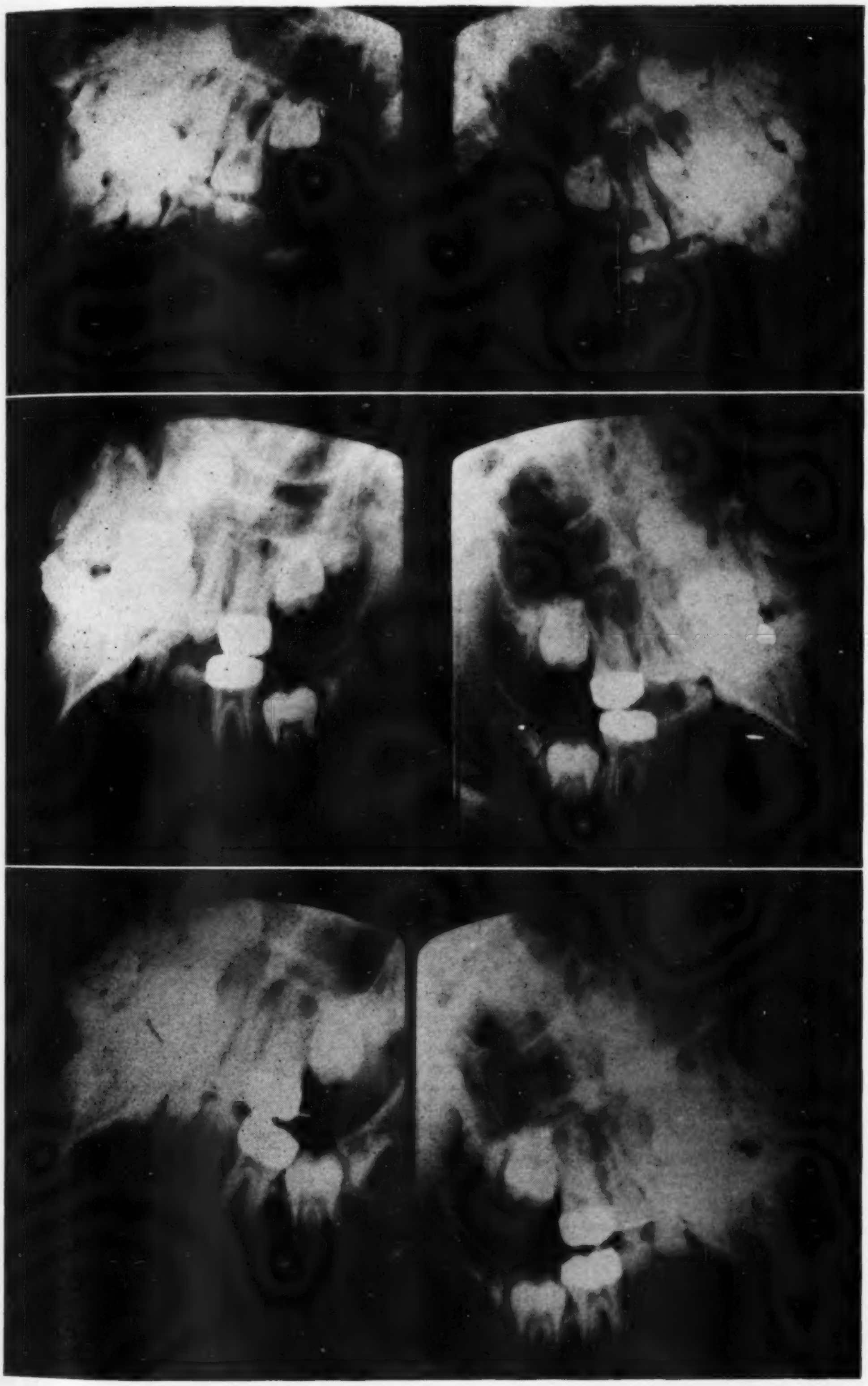
movement of the permanent first molars. (2) The *superposed mandibular diagrams* (Fig. 9, *F*) show considerable forward movement of the entire lower arch. If we bear in mind that no mandibular appliance or Class II intermaxillary elastics were used, we may conclude that the corrected molar relationship and the improved facial balance are the results of a repositioning of the entire mandible. The *superposed sagittal diagrams* (Fig. 10) show that this change in the position of the mandible has taken place. Fig. 8, *E* shows the lateral jaw roentgenograms seven months later, during retention.



A. *B.*

Fig. 8.—Case 617. *A,* Facial photographs before treatment. *B,* Facial photographs at end of occipital anchorage. *C,* Lateral jaw roentgenograms before treatment. *D,* Lateral jaw roentgenograms at end of occipital anchorage. *E,* Lateral jaw roentgenograms seven months after end of occipital anchorage during retention.

This case required a second period of treatment which had for its objective the following: (1) to regulate the mandibular arch, and (2) to correct the excessive overbite.



C.

D.

E.

Fig. 8.—*C, D, E* (For legend, see opposite page).

A.

B.

C.

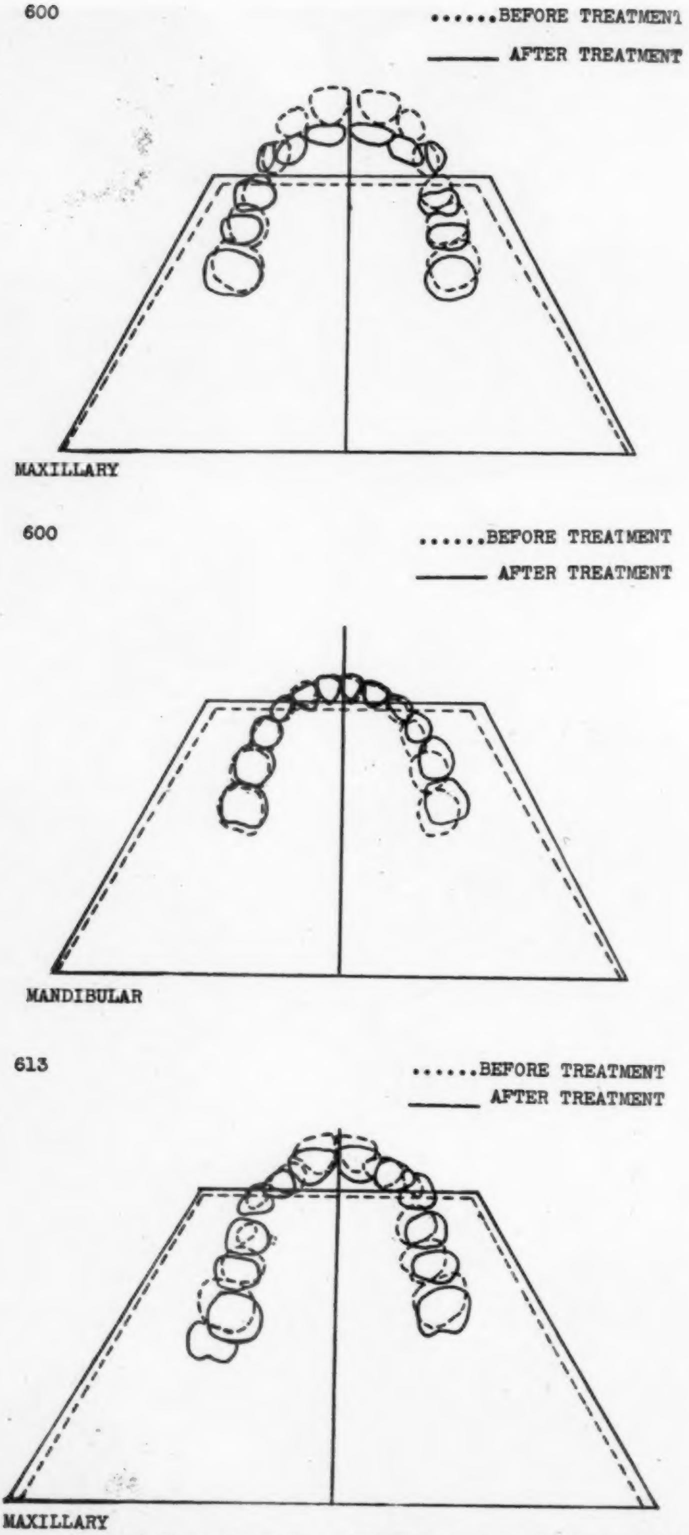
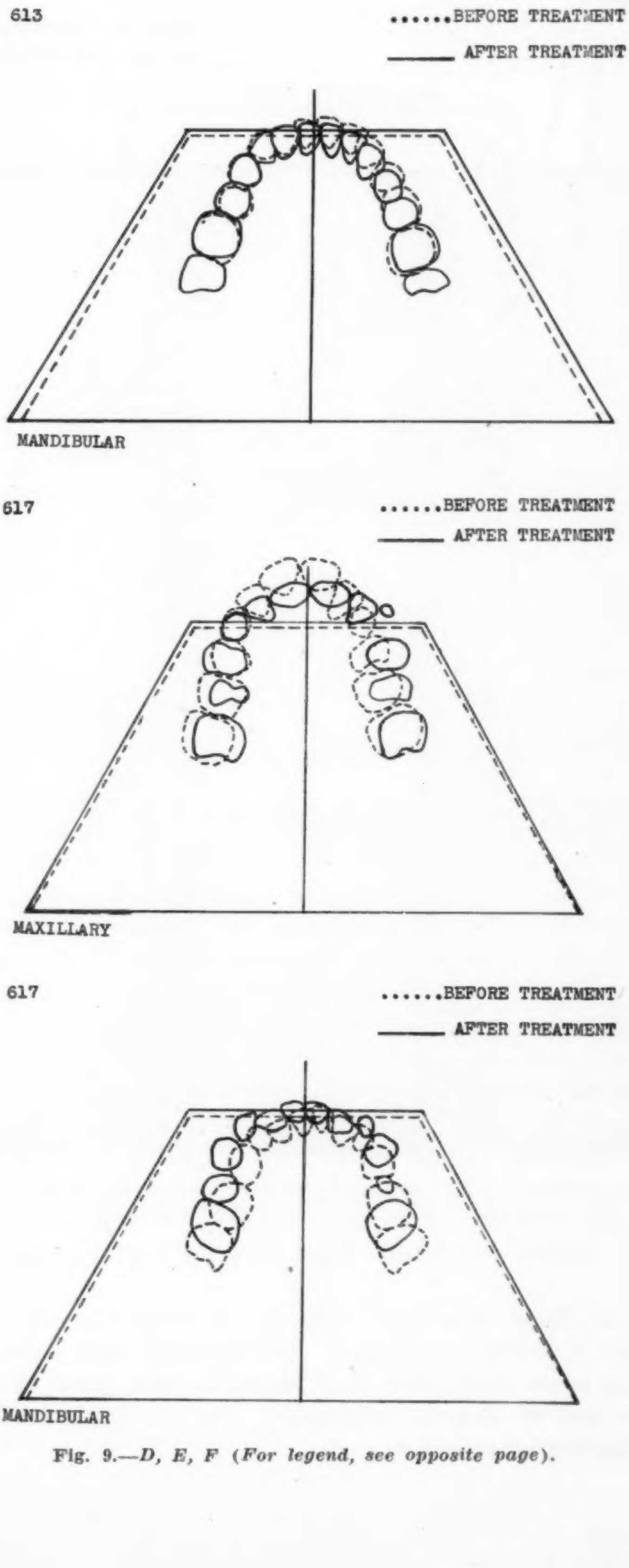


Fig. 9.—Superposed projections of teeth on Frankfort plane before treatment and at end of occipital anchorage. *A*, Case 600; maxillary diagram. *B*, Case 600; mandibular diagram. *C*, Case 613; maxillary diagram. *D*, Case 613; mandibular diagram. *E*, Case 617; maxillary diagram. *F*, Case 617; mandibular diagram.



D.

E.

F.

Fig. 9.—*D, E, F (For legend, see opposite page).*

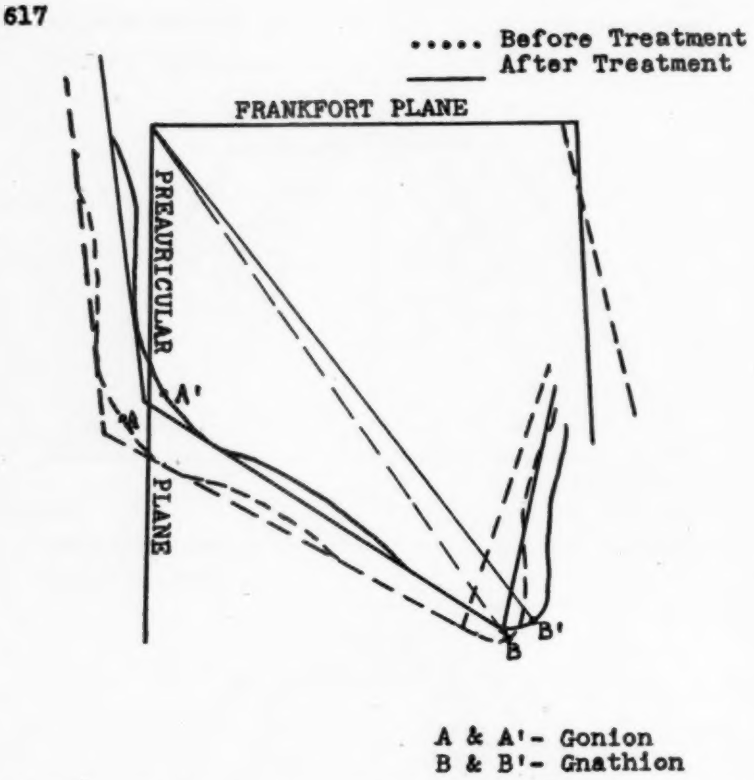


Fig. 10.—Case 617; Superposed sagittal diagrams before treatment and at end of occipital anchorage.

TREATMENT IN THE PERMANENT DENTITION

The next three cases were treated in the permanent dentition.

CASE 583.—Age at the beginning of treatment, 12 years. This case was complicated by the loss of the mandibular first permanent molars and an impacted right maxillary canine. The space for these teeth was completely eliminated by the drift of the surrounding dental units.

Fig. 11, *A* shows the dental casts before treatment. Fig. 12, *A* shows the front facial and profile photographs before treatment. Fig. 12, *C* shows the lateral jaw roentgenograms before treatment.

Mechanics Used.—The two maxillary first premolars were extracted and the impacted maxillary canine was exposed surgically. A maxillary edgewise appliance was inserted. The occipital apparatus was applied to the maxillary arch in the area between the second premolar and first molar. No Class II intermaxillary elastics were used. Total time the headcap was worn is seventeen months.

Analysis of Tooth Movement.—Fig. 11, *B* shows the dental casts of this case at the end of occipital anchorage. The impacted right canine has taken its proper position in the arch. Fig. 12, *B* shows the front facial and profile photographs at the end of occipital anchorage. Fig. 12, *D* shows the lateral jaw roentgenograms during retention.

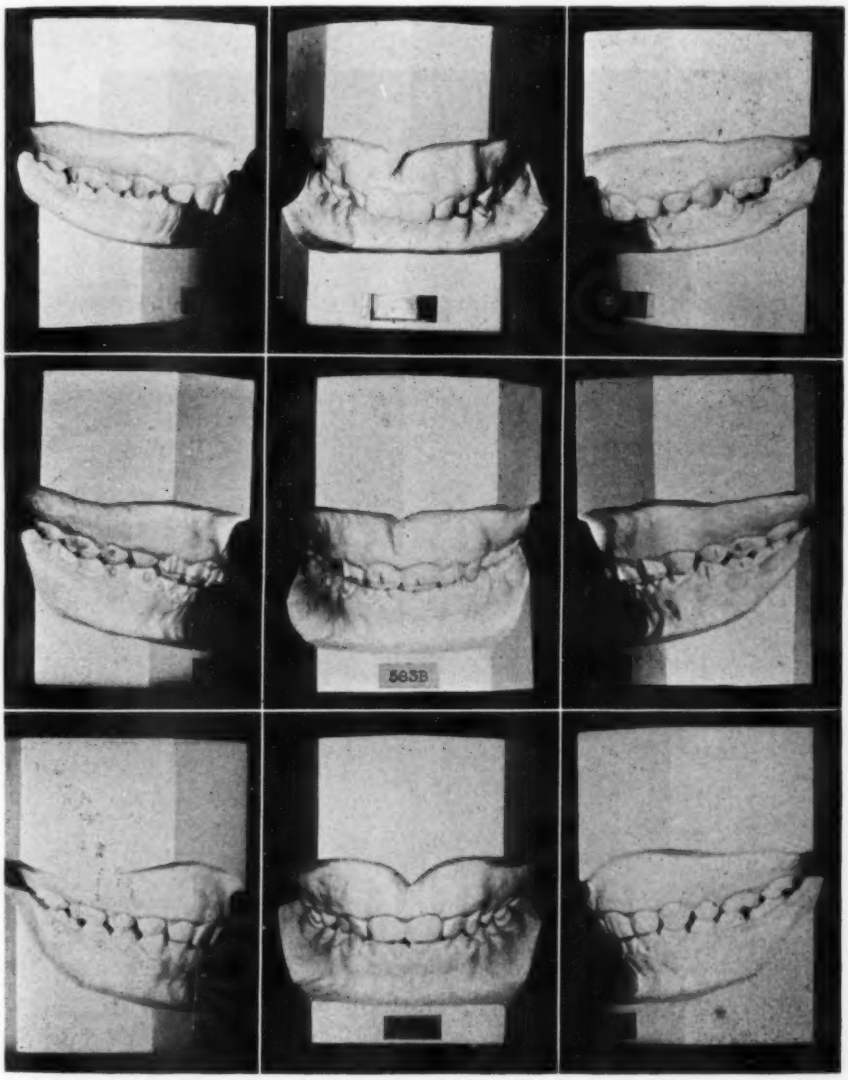
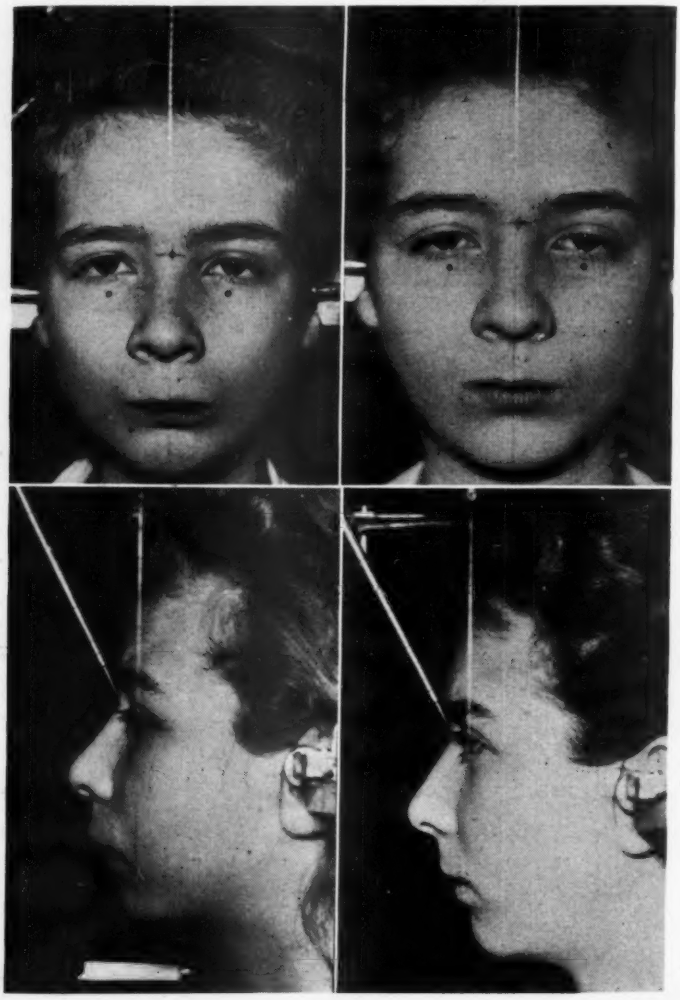


Fig. 11.—Case 583. *A*, Dental casts before treatment. *B*, Dental casts at end of occipital anchorage. *C*, Dental casts ten months after end of occipital anchorage.

Graphs representing the projection of the teeth on the Frankfort plane before and after the use of occipital anchorage show the following changes: (1) The *superposed maxillary diagrams* (Fig. 17, *A*). (a) *From the median plane.*—There is no change in the asymmetry that was present at the beginning of treatment. (b) *From the preauricular plane.*—The entire maxillary arch was moved posteriorly. (c) Natural growth of the face is in a backward direction expressed



A. *B.*

Fig. 12.—Case 583. *A*, Facial photographs before treatment. *B*, Facial photographs at end of occipital anchorage. *C*, Lateral jaw roentgenograms before treatment. *D*, Lateral jaw roentgenograms during retention.

in a shorter Frankfort quadrilateral at the end of treatment. (2) The *superposed mandibular diagrams* (Fig. 17, *B*). The mandibular teeth are farther back than at the start of treatment. Broadbent[3] in reporting a similar facial change in a treated Class II, Division 1 case says: "Here is evidence that instead of the normal downward and forward developmental trend during this

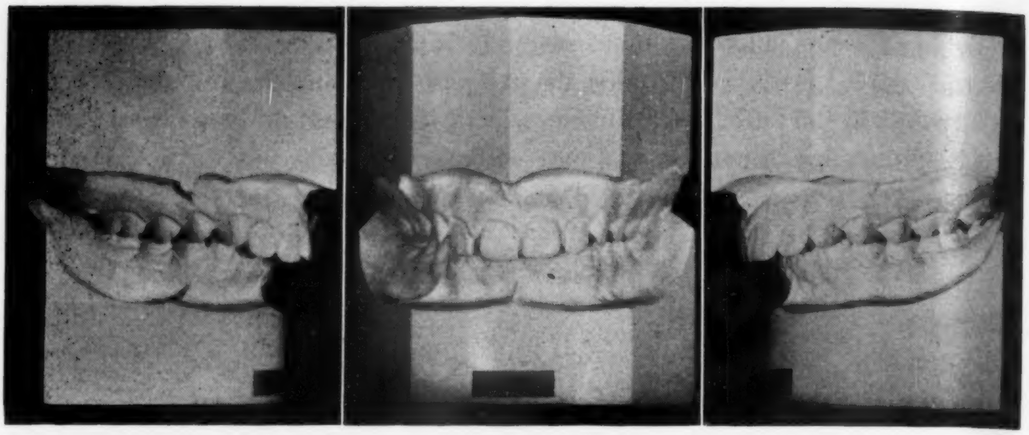
two-year interval, the facial changes have been downward and backward in relation to the unchanged cranial base and outline of the head. This abnormal trend of development has included the eye and ear points as well as the dento-facial points in the lower face. Instances of such aberrant developmental growth have been recorded in untreated as well as treated cases."

Fig. 11, *C* shows the dental casts ten months after the end of occipital anchorage.

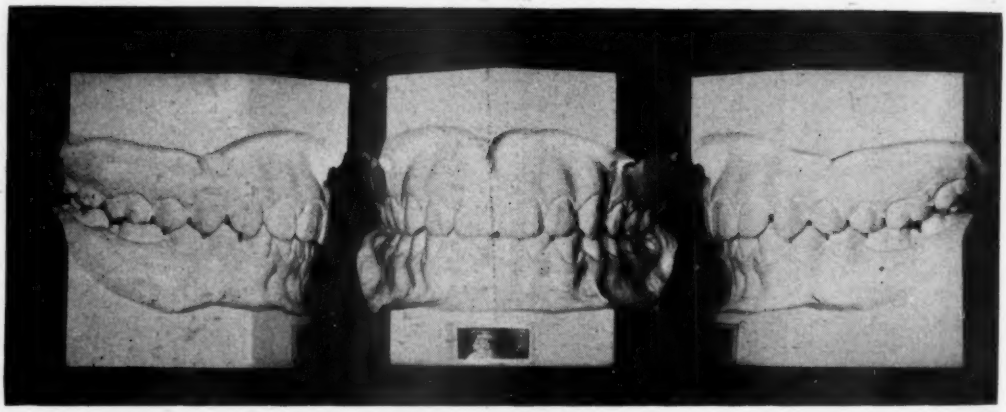
C. *D.*

Fig. 12.—*C* and *D* (*For legend, see opposite page*).

CASE 592.—Age at the beginning of treatment, 13 years, 6 months. Fig. 13, *A* shows the dental casts of this case before treatment. Fig. 14, *A* shows the front facial and profile photographs before treatment. The first molar on the lower right side overlapped the mesial of the second permanent molar inter-



A.



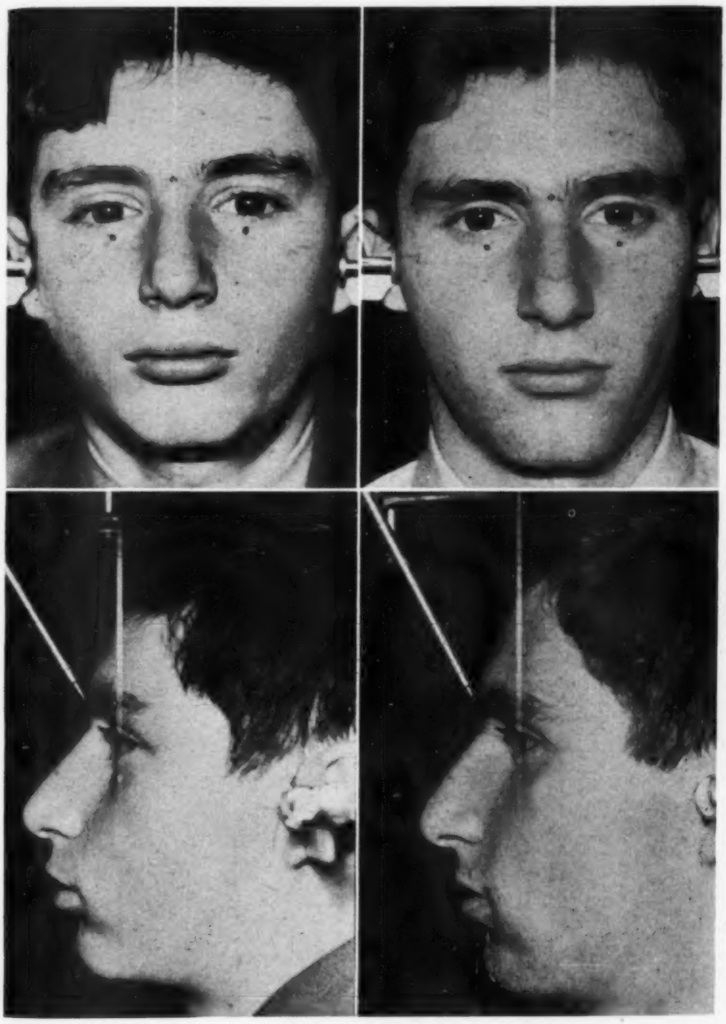
B.

C.

Fig. 13.—Case 592. *A*, Dental casts before treatment. *B*, Dental casts at end of occipital anchorage. *C*, Dental casts ten months after discontinuing retaining appliances.

fering with its eruption. Fig. 14, *C* shows the lateral jaw roentgenograms before treatment.

Mechanics Used.—The four third molars were extracted. The occipital apparatus was applied to the maxillary arch in the canine area. The mandibular appliance was used to control occlusal contact with the maxillary arch. No Class II intermaxillary elastics were used in treatment. Total time the headcap was worn is nine months.



A. *B.*

Fig. 14.—Case 592. *A*, Facial photographs before treatment. *B*, Facial photographs at end of occipital anchorage. *C*, Lateral jaw roentgenograms before treatment. *D*, Lateral jaw roentgenograms at end of retention. *E*, Lateral jaw roentgenograms ten months after end of retention.

Analysis of Tooth Movement.—Fig. 13, *B* shows the dental casts at the end of occipital anchorage. Fig. 14, *B* shows the front facial and profile photographs at the end of occipital anchorage.

C.

D.

E.

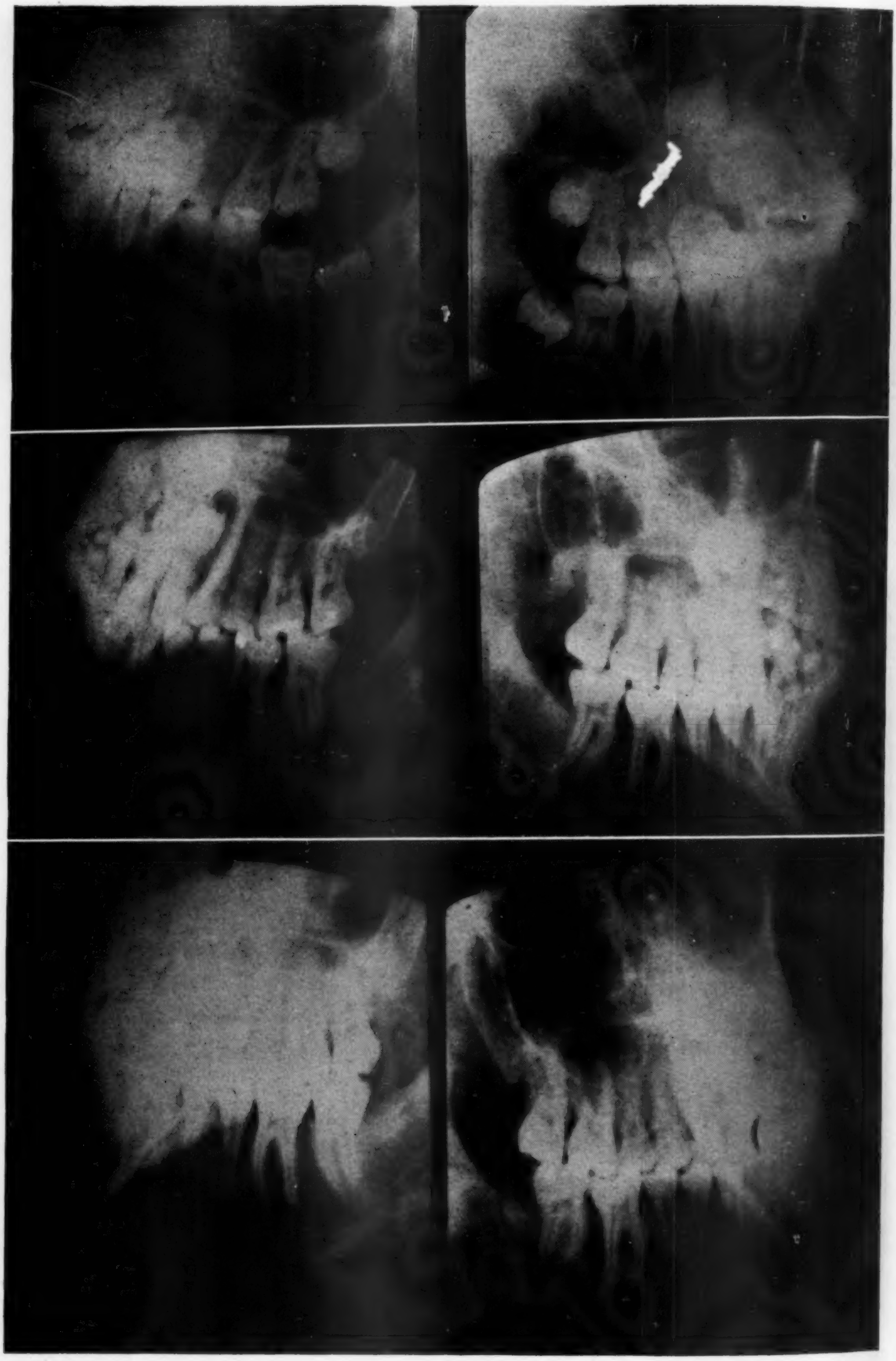
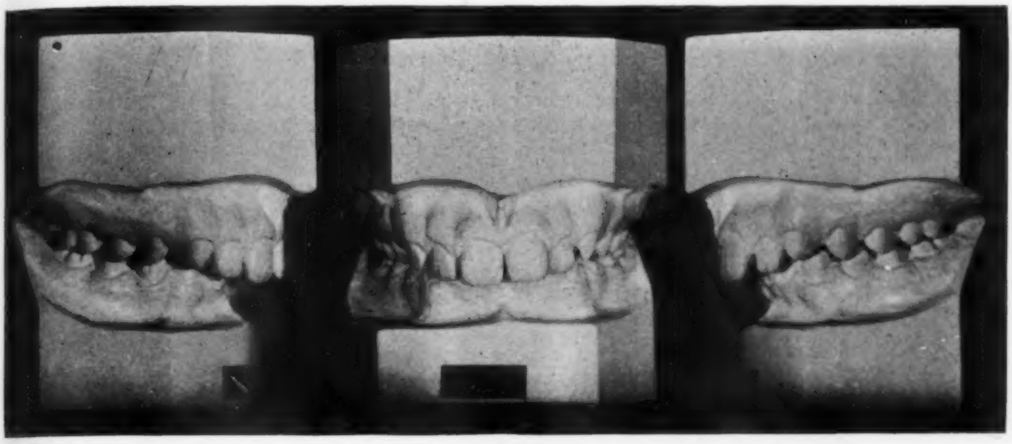
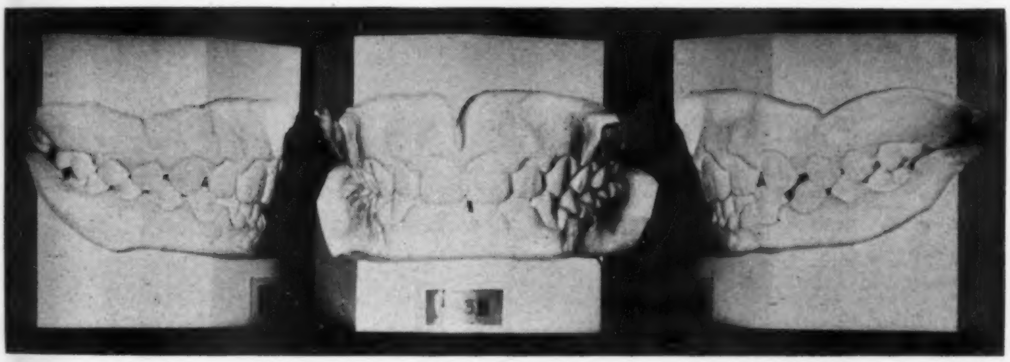


Fig. 14.—Case 592. *C*, Lateral jaw roentgenograms before treatment. *D*, Lateral jaw roentgenograms at end of retention. *E*, Lateral jaw roentgenograms ten months after end of retention.

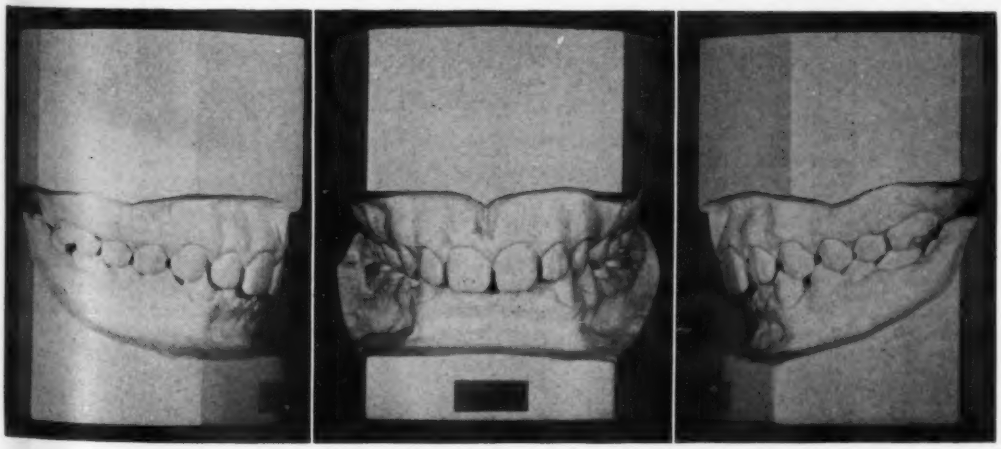
The projection of the teeth in the Frankfort plane shows the following changes: (1) The *superposed maxillary diagrams* (Fig. 17, *C*). (a) *From the median plane.*—The lateral halves of the dental arch are symmetrical as compared with the asymmetry at the beginning of treatment but the arch is wider



A.



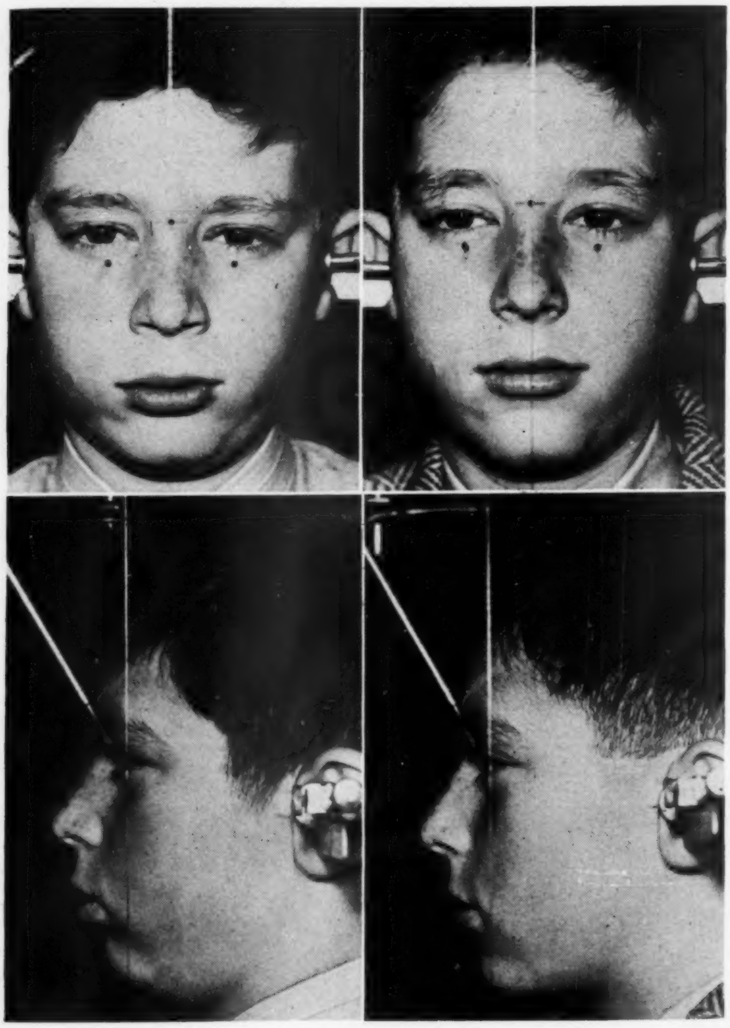
B.



C.

Fig. 15.—Case 593. *A*, Dental casts before treatment. *B*, Dental casts at end of occipital anchorage. *C*, Dental casts two months after end of retention.

at the end of treatment. (b) *From the preauricular plane.*—The graph shows no posterior movement of the maxillary arch. (2) The *superposed mandibular diagrams* (Fig. 17, *D*). There is a considerable forward movement of the entire mandibular arch. Since no Class II intermaxillary elastics were used it may be concluded that the corrected occlusion was due to a repositioning of the entire mandible to the new maxillary occlusal plane.



A. *B.*

Fig. 16.—Case 593. *A*, Facial photographs before treatment. *B*, Facial photographs at end of occipital anchorage. *C*, Lateral jaw roentgenograms before treatment. *D*, Lateral jaw roentgenograms at end of occipital anchorage. *E*, Lateral jaw roentgenograms eight months after end of occipital anchorage.

Fig. 14, *D* shows the lateral jaw roentgenograms at the end of retention. Fig. 13, *C* shows the dental casts ten months after discontinuing retaining appliances. Fig. 14, *E* shows the lateral jaw roentgenograms ten months after retention.

CASE 593.—Age at the beginning of treatment, 10 years, 6 months. Fig. 15, *A* shows the dental casts before treatment. Fig. 16, *A* shows the front facial and profile photographs before treatment. Fig. 16, *C* shows the lateral jaw roentgenograms before treatment.

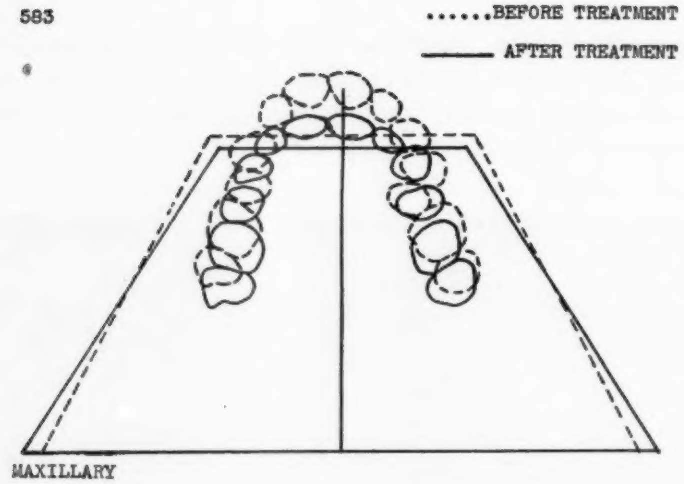
C.

D.

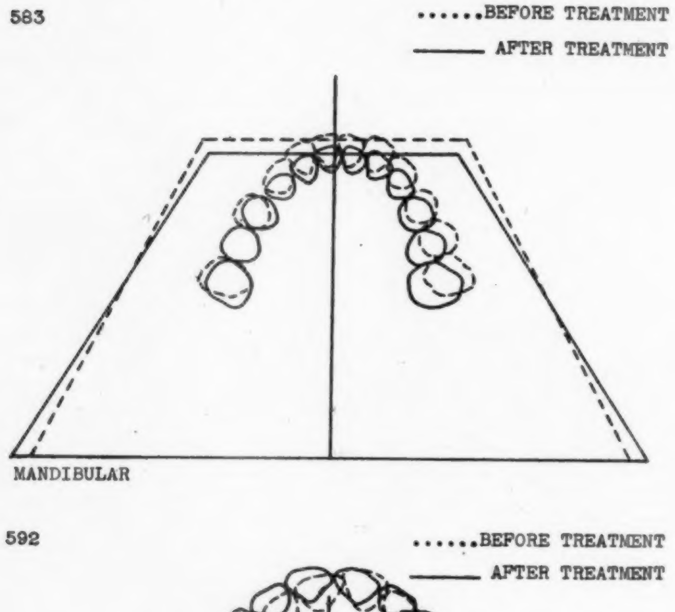
E.

Fig. 16.—*C, D, E* (*For legend, see opposite page*).

A.



B.



C.

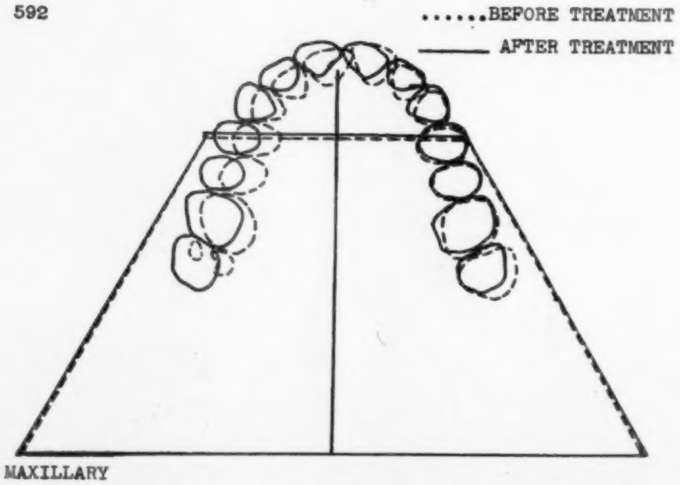


Fig. 17.—Superposed projections of teeth on Frankfort plane before treatment and at end of occipital anchorage. *A*, Case 583; maxillary diagram. *B*, Case 583; mandibular diagram. *C*, Case 592; maxillary diagram. *D*, Case 592; mandibular diagram. *E*, Case 593; maxillary diagram. *F*, Case 593; mandibular diagram. The mandibular diagram of this case was made fourteen months after the maxillary diagram. This explains the difference in the size of the two quadrilaterals.

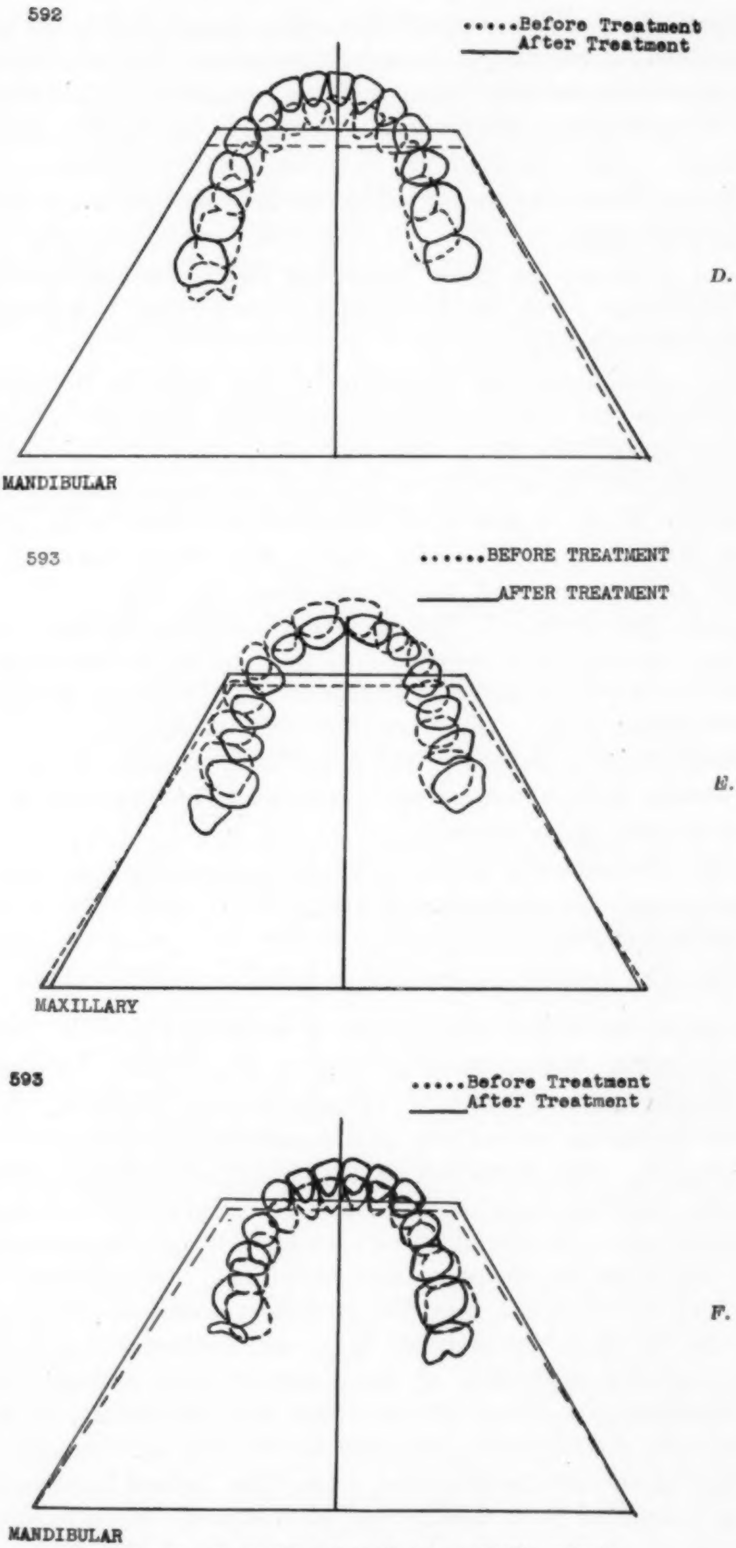


Fig. 17.—*D, E, F (For legend, see opposite page).*

Mechanics Used.—The occipital apparatus was applied to the maxillary arch in the area between the first and second premolars. The mandibular appliance was used to control occlusal contact with the maxillary arch. The headcap was worn for nine months. No Class II intermaxillary elastics were used in the treatment.

Analysis of Tooth Movement.—Fig. 15, *B* shows the dental casts at the end of occipital anchorage.

Fig. 16, *B* shows the front facial and profile photographs at the end of occipital anchorage. Fig. 16, *D* shows the lateral jaw roentgenograms at the end of occipital anchorage.

Graphs representing the projection of the teeth on the Frankfort plane before and after the use of occipital anchorage show the following changes: (1) The *superposed maxillary diagrams* (Fig. 17, *E*). (a) *From the median plane.*—The lateral halves of the dental arch are symmetrical as compared with the asymmetry at the beginning of treatment and there is no expansion of the arch. (b) *From the preauricular plane.*—The entire maxillary arch moved posteriorly. *The superposed mandibular diagrams* (Fig. 17, *F*) show that the mandible has come forward. The corrected occlusion and improved facial balance in this case has been accomplished by a posterior movement of the maxillary arch and a compensatory readjustment of the entire mandible to the new maxillary occlusal plane. (c) Natural growth of the head is expressed in the larger *Frankfort quadrilateral.* (The mandibular diagram of this case was made fourteen months after the maxillary diagram. This explains the difference in the size of the two quadrilaterals.)

Fig. 16, *E* shows the lateral jaw roentgenograms eight months after occipital anchorage was discontinued. Fig. 15, *C* shows the dental casts two months out of retention.

SUMMARY

This paper has dealt with the use of occipital force for the correction of the anteroposterior malrelationship of Class II, Division 1 malocclusion.

Six treated cases of Class II, Division 1 were reported. At no time has mandibular anchorage with Class II intermaxillary elastics been used during active treatment. The correction of the anteroposterior malrelationship of the dental arches was accomplished by means of occipital force applied directly to the maxillary arch. Of the six cases presented, three were treated in the mixed dentition and three in the permanent dentition. An appraisal of the results showed: (1) In all of the cases the maxillary arch was moved posteriorly except the one in which the occipital force was applied in the intercanine area. (2) This posterior movement of the maxillary arch brought about a correct occlusal relationship between the maxillary and mandibular teeth without any expansion in the dental arches except in the one case in which the occipital force was applied in the intercanine area. (3) The marked improvement in facial balance that resulted from this method of treatment seems to have been due to a readjustment of the various component parts of the dentofacial complex. (4) Several factors may be operative either individually or jointly to produce

this change in the dentofacial complex. In some cases the posterior movement of the maxillary arch produced a compensatory adjustment of the surrounding parts to the mandible. In other cases, there was little posterior movement of the maxillary arch. The entire change was due to a repositioning of the entire mandible to the changed occlusal plane of the maxillary arch. Again in other cases the corrected occlusion and facial change was the result of a combined posterior movement of the maxillary arch and a repositioning of the mandible. Rotations of the entire mandible were not unusual.

In closing, I wish to emphasize that the application of occipital force as presented in this paper was designed to test the efficacy of this force and to evaluate the changes produced by it in the dentofacial complex. This made it essential to omit the use of mandibular appliances wherever feasible. In my usual method of treatment of Class II, Division 1, while occipital force replaces intermaxillary force for the correction of the anteroposterior malrelationship of the dental arches, a mandibular appliance is part of the assemblage.

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ASSUMPTIONS CONCERNING ORTHODONTIC DIAGNOSIS AND TREATMENT

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"No MAN is what he thinks he is, but what he *thinks*, he is!" For clarity of thinking, it is necessary that critical analysis and constructive criticism be applied to what is said and written by members of our own and allied professions. Such is the purpose of this paper, particularly with reference to certain assumptions concerning orthodontic diagnosis and treatment.

Probably never before in the history of orthodontics has there been so much difference of opinion among the members of this field, relative to diagnostic and treatment methods and procedures. It is well that this is true, providing it will provoke the smug and complacent to re-examine the foundation for their beliefs and contentions, cause judgment to be substituted for dogma, and result in progress.

The orthodontist's knowledge of growth, his concept of normal dentofacial and cranial relationships, his understanding of etiology, and his therapeutic methods and clinical experiences may form the basis for his diagnostic and treatment assumptions. However, often for this basis many of us rely upon the interpretations and advice of those supposedly better qualified for guidance. These are usually those who write or teach and who, in so doing, should realize that they assume a tremendous responsibility.

While many orthodontists believe that a number of diagnostic aids should be assembled before entering into the diagnosis of dentofacial deformity, some have assumed that an artistic sense, plus previous experience and an unoriented cast of the teeth are all that is necessary to satisfy their diagnostic ambitions. Undoubtedly, an artistic sense is a valuable attribute of the orthodontist, but it is an intangible; and experience, although it may still be the best teacher, takes time to acquire. The student just being introduced to this interesting specialty must be given more than intangibles upon which to base his diagnosis and the experience of others must be carefully and correctly interpreted for him. One might wonder whether some of the new diagnostic aids now available may prove to be the answer to the question of whether the student not gifted with an artistic sense might be trained to make a satisfactory diagnosis.

Angle,[1] in 1899, gave to the profession a usable classification of malocclusion, and some orthodontists appear quite willing to assume that, once the classification is decided upon, their diagnosis of a dentofacial deformity is

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complete. But with changing ideas of the importance of the teeth in dentofacial deformity, some now consider such an assumption too limited in its scope. The upper and lower dentures may exhibit a Class I, II, or III interdigitation, but it is still important to consider their relationship to the basal bones of the jaws, and of the jaws in turn, to the cranium. Angle expected his classification to be a brief, convenient method of grouping deformities with certain similar relationships, especially of the teeth, but did not assume it would be considered a complete detailed tabulation of diagnostic findings.

In order to have a starting point from which to judge deviations from the normal, Angle also called attention to the constancy of position of the maxillary first permanent molar. To the extent that Angle did not relate this tooth to any bony landmark in the skull, it remained an intangible, and perhaps he was too enthusiastic in his contention that its position remained constant. As a result, some who failed to read *carefully* what he said regarding this tooth, or who disregarded possible etiological changes in its position, assumed its constancy of position, under all circumstances, with resulting failures in diagnosis in some instances.

Simon,[2] Broadbent,[3] Tweed,[4] and others also have suggested certain tooth and tooth-basal bone relationships or inclinations, as well as certain relationships of the dentofacial structures to planes of the head, as starting points for diagnosis. Some orthodontists have assumed that these were infallible guides and have met with disappointment in their use, while others have thought that, if in any case their validity could be questioned, they were valueless. This latter attitude was taken by many relative to the diagnostic methods of Simon, because of his so-called "Orbital-Canine Law." Since many assumed that he had said that the orbital plane would always pass through the tip of the canine, they failed to utilize one of the best diagnostic aids ever presented to the orthodontic profession. It is only necessary to read Simon's book to see how erroneous this assumption is. The cephalometric roentgenograms used by Broadbent and others have met the same fate, undoubtedly because the equipment is too expensive, or is assumed by those unfamiliar with its use to be too complex.

Perhaps the assumptions regarding what constitutes the "normal" in dentofacial and cranial relationships arouse such great interest and, often, controversy, because of the diagnostic and treatment assumptions they in turn provoke. For example, the whole question of extraction revolves about various individual concepts of the normal.

Extraction is not new. Indeed, it has always been practiced by some orthodontists, judiciously, they assumed; but that it had reached what some considered alarming proportions by the end of the last century is evident from the following statement appearing in a paper written by Angle[5] in 1906: "On one point you will find they (the old school) have usually agreed . . . and that is there must be some extractions—from a single tooth to even five—four premolars and a lower incisor . . . and even then the writer complains the mouth was still too prominent. Another case . . . required the sacrifice of six beautiful premolars and one fine first molar to reduce facial prominence, but without success."

These orthodontists of the "old school," as Angle referred to them, perhaps had a very limited concept of normal occlusal relationships for, as Brodie[6] wrote, "It seems surprising to us now that normal occlusion, or the definite form relations of the teeth of the lower arch to those of the upper, should not have been noted until well towards the end of the nineteenth century. The Angle Classification in 1899 was based on these relations and was almost immediately adopted as the basis for all diagnostic work."

Angle's[5] normal consisted of a "full complement of teeth," supposedly correctly occluded and oriented with respect to the facial and cranial structures, although his writings and illustrations indicated that his normal allowed a variety of such orientations (Figs. 1 and 2). For example, the skull (Fig. 1) taken from one of Angle's early papers showing the dentures well back on the basal bones was described by Angle as having, "The straight line of the profile and general fine balance," while that in Fig. 2 has the dentures well forward on the basal bones. With respect to this skull, Angle stated, "But even in this most extraordinary type I think we still see with equal truth and clearness Nature's beautiful plan of normal occlusion, and of facial balance with type, as we did in Fig. 1."

Tweed's[7] normal, undoubtedly the one that many would prefer, is similar to the straight line profile of the skull in Fig. 1, although flatter in the dental area. In fact, Tweed allows no variation, for as he stated, "Some of you might say that the normal, as I envisage it, has a mandible that is slightly anterior to the true position in relation to the skull, and that the individual teeth in the mandible are a little too upright or vertical. It is true, the lower incisors and cuspids are so vertical that when ready for retention they might even give the impression of retruding slightly. There is no protrusion of the alveolar process in the lower incisal region, and the mandible is firm and prominent. Though difference of type should of course be considered, my vision of the normal allows of no variation; it seems a piece of precision machinery."

With these diverse concepts of the normal in mind, let us consider their influence on the resulting diagnostic and treatment assumptions, especially with respect to the reasons for and against extraction. Supposedly, the "old school" assumed that if the teeth were in malocclusion, there was insufficient basal bone for their support and nothing they could do would correct this discrepancy. Thus, there was no alternative but to remove the required number of teeth to allow alignment, but more particularly to improve facial esthetics. The literature would indicate that the "old school" preferred the teeth back on the basal bone, or the straight profile, and where necessary to achieve this, extraction was the rule. Angle[5] evidently considered their goal to be mostly beauty, since he says the "old school" believed, "That we of the New School do wrong in placing efficiency of the teeth before beauty, instead of making beauty the goal to be sought for in treatment as they do."

In contrast to this treatment of the "old school," Angle and others who did not believe in extraction evidently assumed that the teeth inherited by an individual were always of a size compatible with that of the face. That this is true seems improbable to some who support extraction, assuming that the ob-

servations of certain anthropologists are correct. They point out that with the passing of time, the face has gradually diminished in size, while the size of the teeth has shown little or no appreciable change. Furthermore, some individuals with apparently inherited small faces have teeth that measure considerably more

Fig. 1.

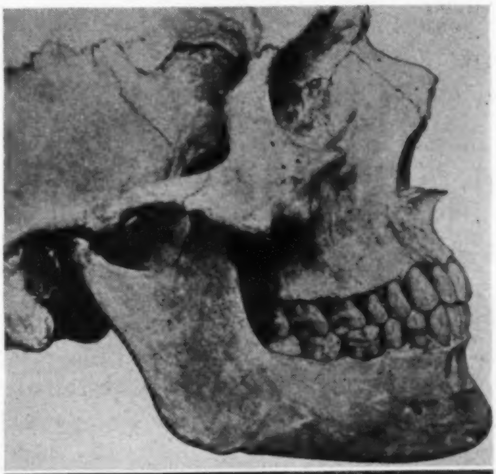

Fig. 2.

Fig. 1.—Angle described this skull as having a "straight line profile" consistent with type. (From Angle, E. H.: Items Interest 28: 431, 1906.)

Fig. 2.—Angle described this skull as having Nature's beautiful plan of normal occlusion and facial balance with type. (From Angle, E. H.: Items Interest 28: 433, 1906.)

than the average mesiodistal dimensions given by Black. Naturally, under such circumstances there would be insufficient room for the teeth and, if the anthropologists are correct, it may follow that no present-day individual would have room for all thirty-two teeth.

Those against extraction assumed that, when the teeth were moved orthodontically into correct occlusal relationships, the normal function that ensued

would stimulate the musculature and basal bone to change both in size and shape, to conform to the dictates of the newly established occlusion. Lundstrom[8] referred to these orthodontists as occlusionists. The occlusionists' contentions are discounted by those who believe in extraction because the findings of some investigators, revealed principally through cephalometric studies, indicated that no particular change occurred in the size or shape of the facial structures after correcting the occlusion. Thompson[9] stated, for example, "Orthodontic treatment may straighten the teeth, but it will not straighten the face." This assumption, however, is questioned by those who treat facial deformities at an early age.

It was also assumed by those who did not wish to extract that teeth could always be moved to the desired positions. This, in turn, is disputed by those who extract as they again cite the findings of cephalometric investigations. Some cephalometric appraisal of orthodontic treatment indicated that, even with the most exacting techniques, teeth cannot always be moved as anticipated. For example, some investigative work[10] indicated that when distal movement of the maxillary posterior teeth was attempted, these teeth failed to move to the desired position, while the mandibular teeth that were being used for anchorage might instead be moved mesially. On the other hand, other highly respected operators are confident that they obtain distal movement of the maxillary posterior teeth. The above controversial opinions indicate that further investigative work is needed before these contentions are substantiated.

Diagnostic and treatment assumptions relative to extraction gained impetus when highly respected orthodontists like Grieve and Tweed[11] subscribed to the assumption that the lower incisors in Angle's Class II deformities are always too far forward with respect to the mandibular basal bone. This idea was based on an earlier one, namely, that in such deformities the mandibular basal bone was short anteroposteriorly, which resulted in a forward translation of the lower teeth because of insufficient room anterior to the ramus. Cephalometric studies by Nelson,[12] among others, supported this short mandible premise only to a minor degree. His findings indicated that the mandibles in Class II deformities, taken as a group, are slightly shorter on the average than in the group including both normal occlusion and Class I malocclusions. Interesting enough, however, was his finding that the range in the mandibular dimension was almost the same for both groups. This would indicate that the anteroposterior basal bone length in Class II deformities should not be assumed to be short but should be investigated for each individual case. Studies at the University of Illinois also indicated little, if any, difference in mandibular growth in Class I and II deformities.

Tweed[13] thought he had added further emphasis to the assumption of the forward position of the lower incisors relative to basal bone in Class II through his studies of lower incisal-axial inclination, but this actually does not indicate position. It was pointed out in a previous paper,[14] and later shown by Corlett[15] in a more extensive study of cephalometric roentgenograms of Class II deformities, that lower incisors having the same inclinations could, in one individual, be

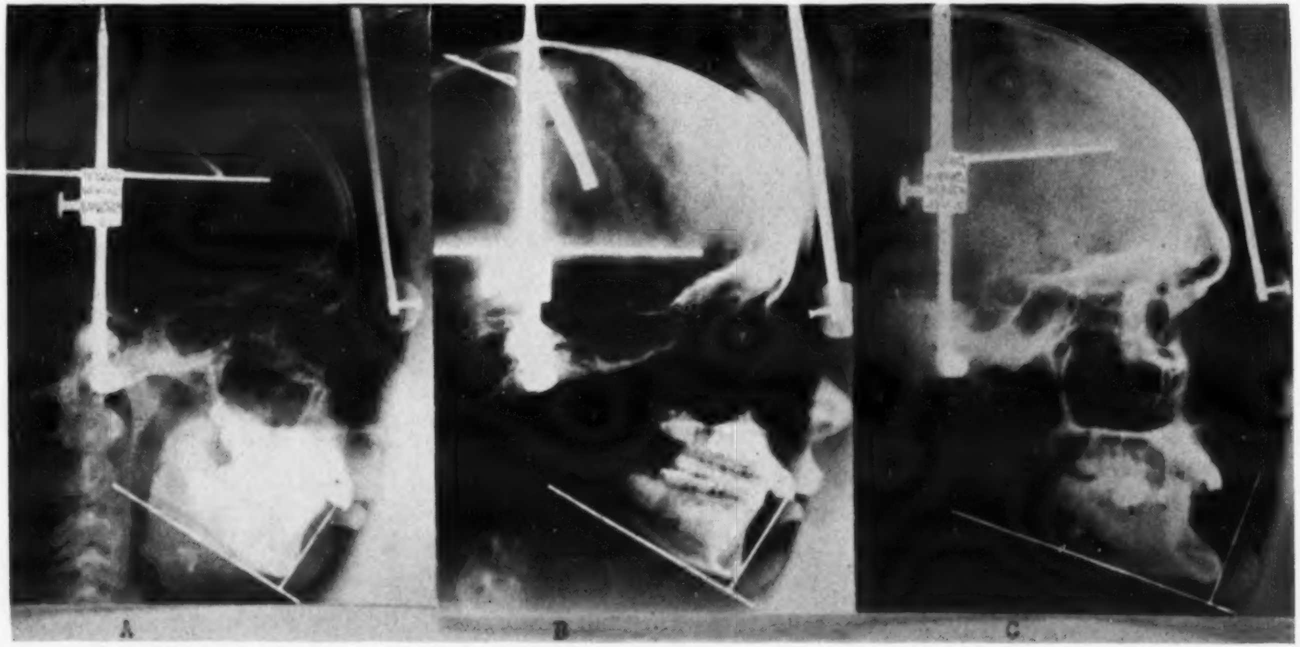

Fig. 3.—Photographs of three profile roentgenograms. The white lines are the mandibular plane, tangent to the lower border of the mandible and the right angle vertical line tangent to the bony chin point (menton). The deformity of each patient is of about equal severity and of the Class II, Division 1 (Angle) type. *A* has a comparatively short mandible but the incisor teeth are back of or on the minus side of the vertical line. *B* has an average-sized mandible with the incisor teeth about the average distance back of the vertical line, while *C* has the lower incisors a considerable distance back of the vertical line.

positioned well forward on the mandibular basal bone, while in another they could be a considerable distance back (Fig. 3).

Since Tweed[7] said, "The mandibular incisors should be positioned upright over the medullary bone of the jaws because all normals are that way," it might be well to examine further the actual relationship of these incisors to the basal bone. This is clearly shown in cephalometric roentgenograms of patients (Fig. 3) and of the well-proportioned skull (Fig. 4), and also in the cross section of a mandible (Fig. 5). Fig. 6 is a roentgenogram of Old Glory, in which a wire has been waxed to the outer surface of the cortical bone of the mandible in the median sagittal plane, starting on the labial at the alveolar crest, running down and around the base and up the lingual surface to the alveolar crest on that side. This simply outlines the alveolar and basal bone of the mandible that is seen in all profile cephalometric roentgenograms. Since, in all such roentgenograms the labiolingual thickness of the mandibular basal bone is thus revealed, as though it were the bone itself cut in cross section, it is then quite easy to see the position of the lower incisor teeth relative to this labiolingual diameter of this bone.

Most orthodontists would agree that the inclination of these teeth should be upright or approximately so, but it might be assumed that Tweed also visualized them as centered buccolingually over the basal bone. Actually this is not the case. In so-called normals, the lower incisors are positioned well toward the compact lingual surface of the basal bone and even in bimaxillary protrusion and extreme Class II, Division 1 dentofacial deformity, in which the lower incisors have considerable labio-axial inclination, that is quite procumbent, the root apices are still near the lingual plate of bone. Thus, if the lower incisor roots are near the lingual compact layer of the mandibular basal bone, or at least the apices are, even though the incisors are quite procumbent, then to move these teeth further lingually would not place them over basal bone, but would serve only to carry them even further off the basal bone in a lingual direction.

Recently, Tweed[4] gave to the profession the Frankfort-mandibular plane angle as an aid to diagnosis and treatment, especially with respect to extraction (Fig. 7). Salzmann,[16] in an editorial commenting on Tweed's new contribution, stated: "By establishing a relationship between the degree of angularity of the Frankfort-mandibular base angle and the height of the ramus of the mandible, Tweed has taken a more positive step, which not only gives a scientific basis to his original conclusions, but also provides definite criteria for extraction as a means of improving esthetics and insuring lasting results." With all due respect to Tweed, his ability, and contribution to orthodontics, it is hardly possible to agree with Salzmann's assumption that the Frankfort-mandibular plane angle is a definite criterion for extraction. Actually, its application is only a rapid method of determining the fact that the mandible is not normal, but it is still necessary to determine whether this abnormality is one of position, form, or size and, if the latter, of which part.

Neither by Tweed's[4] own admission is it a "definite criterion for extraction," for he stated: "If the Frankfort-mandibular plane angle (the figures

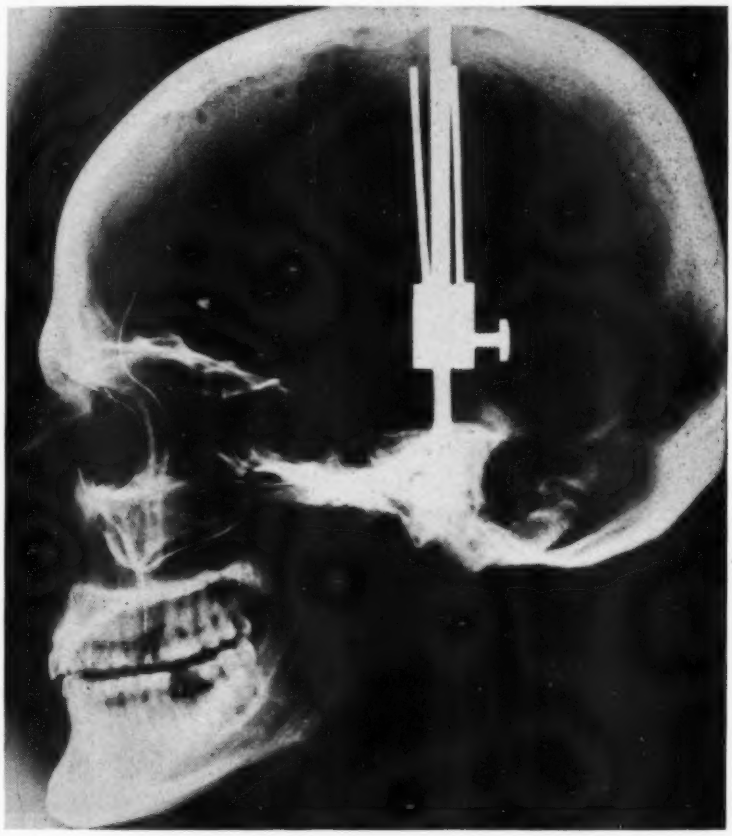

Fig. 4.—Roentgenogram of a well-proportioned skull. Although the lower incisors are upright, they are not centered over the medullary bone but are well back toward the lingual cortical plate. (From Higley, L. B.: AM. J. ORTHODONTICS AND ORAL SURG. 26: 772, 1940.)

Fig. 5.—This photograph of a skull sectioned in the median sagittal plane illustrates how the incisor area of the mandible looks in a cephalometric profile roentgenogram. Although the incisors are upright they are not centered over the medullary bone but are well back toward the lingual cortical plate. (From Strang, R. H. W.: Textbook of Orthodontia, Philadelphia, 1943, Lea & Febiger.)

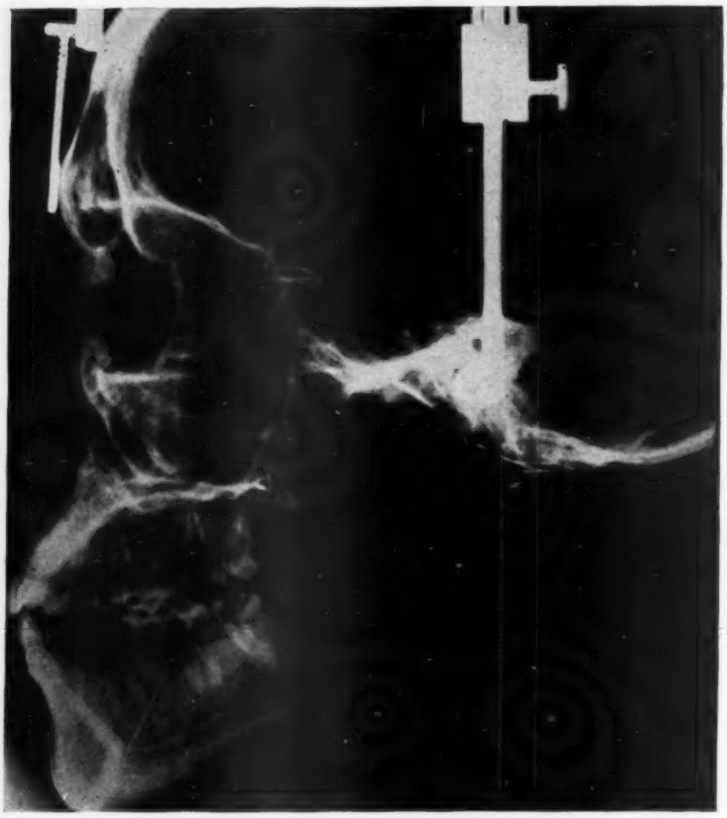

Fig. 6.—This is a roentgenogram of the skull known as "old glory" in which a wire has been used to outline the median sagittal cross section of the mandible as seen in all cephalometric roentgenograms.

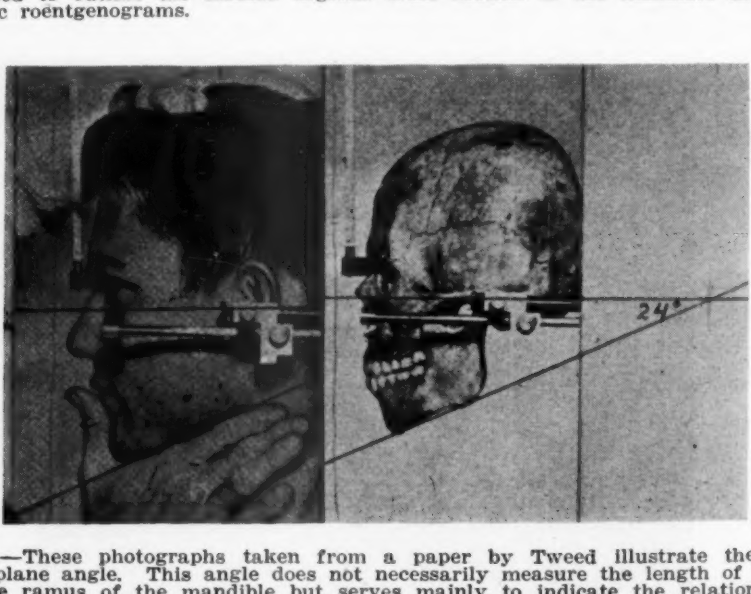

Fig. 7.—These photographs taken from a paper by Tweed illustrate the Frankfort-mandibular plane angle. This angle does not necessarily measure the length of the body or height of the ramus of the mandible but serves mainly to indicate the relationship of the gonial angle to the Frankfort plane. (From Tweed, Charles H.: AM. J. ORTHODONTICS AND ORAL SURG. 32: 204, 1946.)

are at present approximations) is between 16° and 28°, the growth vector has been downward and forward to a degree which is normal. These cases will frequently have normal occlusion or an osseous growth pattern of but slight deviation from normal, even though the malocclusion is of a severe nature. The orthodontist can be reasonably certain of a permanent result with excellent facial esthetics if he will reduce the tooth pattern so that it is in keeping with the osseous bulk, if and when such procedure is indicated." "My opinion is," he continued, "that about 60 per cent of all malocclusion will fall within a 16° to 28° range of the Frankfort-mandibular plane angle, when measurements are taken from profile photographs. More than half of these cases will require reduction of tooth pattern if proportions approximating the normal are to be realized." How to determine which half was not stated. This certainly indicates that Tweed did not assume the Frankfort-mandibular angle to be a definite criterion for extraction, since in this 60 per cent of all cases, or 60 out of 100, judgment is still the only method of deducing when extraction is necessary, because the growth pattern is normal and the angles acceptable. Tweed went on to say that, "virtually all cases showing a Frankfort-mandibular plane angle of from 28° to 35° will require removal of the teeth and, in some instances, the removal of teeth when the angle is 40° or more will detract from, rather than enhance, facial esthetics." From all of this it could be conservatively estimated that for at least 65 out of every 100 patients, the operator would have to rely upon judgment as to the necessity for extraction rather than on the Frankfort-mandibular angle. However, this judgment must be based upon further analysis of the individual patient's deformity.

Actually, there are only two fundamental reasons for extraction. One is to correlate the amount of tooth substance, or more specifically, the summation of the mesiodistal diameters of the tooth crowns with the amount of the present or predicted basal bone support of the jaws. When tooth substance is too great, the only recourse is to extract. The only other logical reason for extraction is if it is found too difficult, if not impossible, to move the teeth from their positions of malocclusion into correct relationship to the available supporting basal bone and into equilibrium with the musculature. On the basis of these two fundamental reasons, the need for extraction can best be decided by measuring the teeth and jaws and by determining the position of the teeth relative to the basal bone through the use of the cephalometric roentgenograms, which still appear to be the best diagnostic aid for this purpose. In fact, Tweed's[4] article on the Frankfort-mandibular plane angle presented some excellent reasons for the use of cephalometric roentgenograms, if certain inferences are drawn from what his article implied.

Acceptable and permanent results are all that can be desired in the treatment of dentofacial deformity. That Strang[17] is pleased with his treatment achieved when extraction is substituted, under certain circumstances, for idealism, is evident when he concluded a recent paper as follows, "I can truthfully state that never before, in all my thirty-nine years of practice, have I come to the end of active treatment of my cases with such a feeling of confidence that

the results I have obtained will remain permanently as a monument to successful orthodontic guidance."

However, at present there seems to be an undercurrent of resignation or futility in the treatment of dentofacial deformities in which there is apparently insufficient, or misdirected, basal bone growth. One reason for this may be because it is assumed that this failure of osseous basal bone growth is a factor over which the orthodontists have no control. Those who hold this assumption must then also assume that deficient jaws are entirely hereditary, or that other etiological factors can inhibit or abnormally direct growth, but that it is impossible to remove this inhibition to growth, stimulate latent growth, or redirect it. This attitude may or may not be justified, but if it is, the treatment objectives of the orthodontist for dental deformities having abnormal environmental structures and undergrown osseous bases will be the same as the prosthodontist, except that the orthodontist will be setting up the natural teeth. That is to say, the size, shape, and relationship of the jaws will be considered as a constant, and the teeth will then be arranged upon them in the best compromise possible to give a functional occlusion and as pleasing facial esthetics as is possible under the circumstances.

This prosthetic attitude is apparent when Strang[17] stated, "If permanent stability is to be the goal of attainment . . . the plan of treatment must aim to preserve those conditions in the deformed denture that simulate the normal, i.e., the balance and harmony of abnormal environmental structures and the essential support of undergrown osseous bases," and later he continued, "We must do the best we can with the faulty structural building elements that are offered us." Is a stabilized denture sufficient to gain our approval if the muscles are to remain abnormal and the jaws deformed, or should we prefer to improve them also if at all possible?

Before this prosthetic treatment objective is accepted by orthodontists, it would seem advisable to ask and attempt to answer certain questions:

1. Do all undergrown and otherwise deformed jaws result only from a faulty inherited pattern?
2. Is it possible that the inherited pattern of the jaws may be inhibited or misdirected during growth?
3. Is it possible that the orthodontist might be able to eliminate inhibitions to growth and redirect it?

Few orthodontists assume that deformity of the jaws is entirely inherited, because there appears to be ample evidence that other etiological factors have a marked influence on their size and shape. If jaws can be deformed by etiological forces of, for example, a pressure or tension type, then it would be logical to believe that, at least in these deformities, early elimination of the abnormal forces, plus the substitution of counteractive ones, not only should prevent the deformity from becoming worse, but should actually improve the condition.

Perhaps this prosthetic attitude based on the feeling of futility in attempting to prevent or correct jaw deformity gained impetus through a questionable interpretation of etiological influences on the time gradient of basal bone growth.

Strang[11] stated, "Growth of the basal bones has a time gradient, and when growth in a certain area is checked during a specific period assigned to this part, it is lost forever after." This implies an etiological factor other than the hereditary pattern as being responsible for deformed jaws, but otherwise appears to be a misinterpretation of research findings. These findings do not indicate that growth checked during a specific time is necessarily lost forever, but only that it may be. Actually, most findings show that a considerable amount of the checked growth is regained after the cause is removed. This is also borne out by the fact that all adult jaws are practically equal in size.

Strang[11] in one portion of his text stated, "The bony effects of tooth movement are limited almost entirely to the alveolar process and that functional forces, brought back to normal power and direction, have little influence on an undergrown basal bone because the growth period has probably expired." Perhaps most orthodontists are now of the opinion that basal bone is not stimulated to grow in direct response to tooth movement, but that, indirectly, tooth movement may eliminate etiological inhibitory forces and re-establish functional forces that may allow growth, stimulate latent growth, or redirect it, especially if this is done before the growth period *has* expired.[18] For example, the tooth movement accomplished during treatment of the dentofacial deformities in the 3- and 4-year-old patients illustrated in Figs. 8 and 9 has, it would appear, eliminated certain faulty jaw and denture-lip relationships, which etiological factors may have been inhibiting or misdirecting growth, but which, being eliminated, may allow growth to proceed unhampered. If these etiological factors *have* no effect on the dentofacial growth, then such an assumption would be wrong; but *if* they do not, then many previous assumptions relative to the importance of local etiological factors in the production of dentofacial deformities need re-examination. If, on the other hand, these local etiological factors are important but are not removed by early treatment before the growth period has expired, then changes in the musculature and undergrown or deformed basal bone *would* be improbable.

That basal bone changes did occur with the correction of the occlusion was, as previously stated, the assumption of the occlusionists and others before the present prosthetic attitude toward orthodontic treatment crept into the literature. Strang,[11] for example, in another portion of his text, does not seem so emphatic about the fact that a re-established functional force may not have some influence on basal bone, for he stated, "This force is disseminated throughout the alveolar process and underlying basal bones and has a stimulating effect in a forward direction. Whether or not this is felt beyond the confines of the alveolar process is, of course, problematical, but that Tweed's results show greater prominence of bone in the area of the mental tuberosity than cases treated otherwise, cannot be questioned. This may be due to an adjustment taking place in the region of the necks of the condyles where there are growth centers that remain active longer than other growth centers of the mandible." Tweed,[11] in a personal communication to Strang, indicated that he also formerly considered it possible to change basal bone by orthodontic treatment

as is indicated in the following excerpts from this letter, for he states, "In my opinion, there is more change in mandibular basal bone than there is tooth movement in the treatment of Class II malocclusion. We actually stimulate dormant growth forces in the body of the mandible, and this growth must be

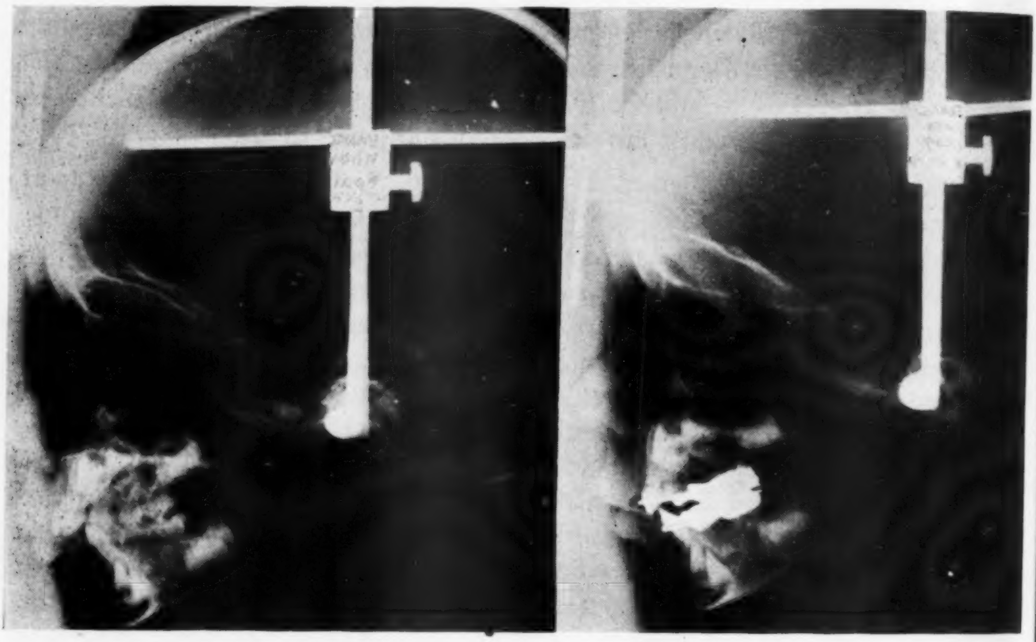

Fig. 8.—The early correction of the dentofacial deformity illustrated in the above before and after treatment roentgenograms undoubtedly eliminated etiological inhibitory forces and re-established functional forces that may allow growth, stimulate latent growth, or redirect it.

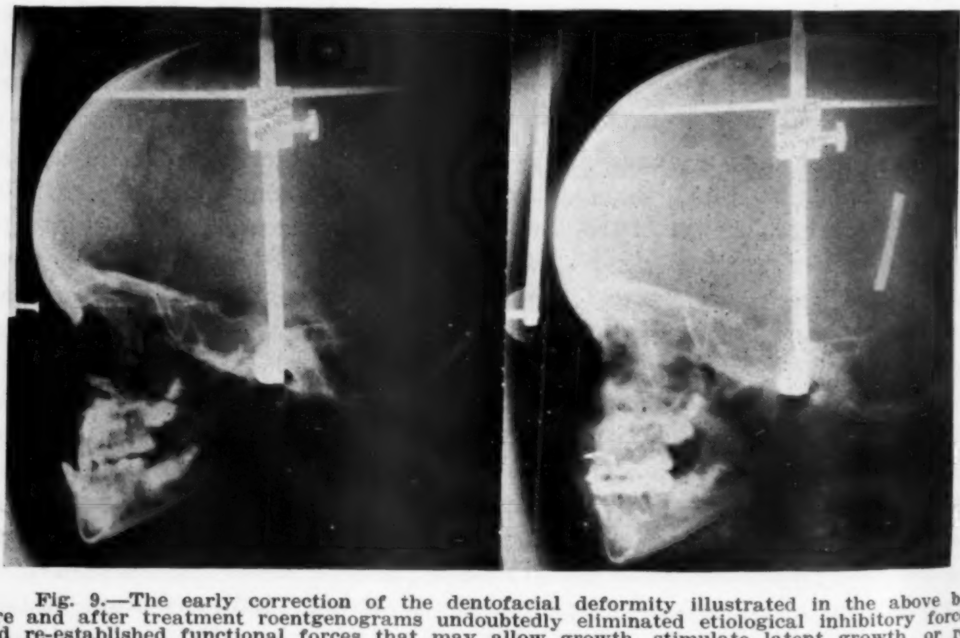

Fig. 9.—The early correction of the dentofacial deformity illustrated in the above before and after treatment roentgenograms undoubtedly eliminated etiological inhibitory forces and re-established functional forces that may allow growth, stimulate latent growth, or redirect it.

quite rapid. The reason that I have been able to secure more mandibular development than most operators is simply due to the fact that my stimulation . . . has been transmitted to basal bone by a dynamic anchorage while their stimulation has been misused in displacing mandibular teeth mesially so that little was felt on the basal bone.''

Thus we see that not so long ago Tweed was convinced that his treatment did stimulate growth of basal bone, particularly in the mandible, with resulting improvement of facial esthetics. One wonders then whether the shift to the prosthetic attitude in which there is, supposedly, no basal bone change, is warranted. It might also be logical to ask what the result would be if extraction were resorted to in order to place the teeth in harmony or equilibrium with an undergrown basal bone and in the process of treatment or, subsequent to it, the basal bone should happen to grow in the same manner as was noted by Tweed in previously treated nonextraction cases.

One final analysis of a previously stated assumption may prove of value. This assumption is to the effect that all occlusions, whether acceptable, or not, eventually come into balance with all of the forces, normal or abnormal, that play upon them. With this most orthodontists undoubtedly agree. This is true not only of the occlusion but of the basal bones, muscles, and all other structures of the face. Incidentally, it is difficult to understand why we should continue to limit our field by describing the deformities with which we deal as malocclusions of the teeth rather than as dental and dentofacial deformities. Several years ago, in order to include more than the teeth, a new definition of the normal was proposed in which the phrase ''dento-facial relationships'' was substituted for occlusion and the word equilibrium for balance.[14]

Equilibrium in the denture results when the internal muscle force counteracts the external. It is generally accepted that it is the tongue alone that acts on the lingual side of the denture. The tongue, therefore, if this be true, becomes an important equilibrium factor in the normal moulding of the denture and, at times, an important etiological factor in the production of denture deformity. It may be logically asked, then, whether it is possible to have denture stability after moving the incisor teeth lingually unless the tongue will adapt and come into equilibrium with the new position of these incisor teeth. If it is impractical to expand dental arches buccally, as is now being suggested by some orthodontists, because the existing abnormal muscular pressure of the cheeks will force these teeth back lingually into their former equilibrium, it should be equally untenable to carry incisors lingually if they owe their former position to an equilibrium between the muscular pressure of the tongue lingually and that of the lips labially. Yet this latter procedure does not seem to be questioned.

If it is true that the incisors in dental deformity are in equilibrium with the labial and lingual muscular pressures, and this equilibrium can be upset by moving the incisors lingually with no appreciable relapse, then the assumption that abnormal muscular pressures cannot be changed, within limits, to be in keeping with the new positions of the teeth, is not sound. These statements now being made to the effect that lateral expansion of deformed dental arches

should not be a part of the corrective procedures exclude the possibility of any muscle adaptability whatsoever. In deformities in which the dental arches are very narrow, correction without expansion would necessitate considerable extraction and even then the result would be far from pleasing. It is undoubtedly true that a narrow denture may have come into equilibrium with the musculature within which it is confined, but it is to be hoped that the prosthetic assumption that it is impossible to expand laterally because the musculature is not amenable to any change is fallacious. What is probably intended, by those who would eliminate expansion from corrective procedures, is a warning against overexpansion. If it is so important to position the mandibular incisors correctly relative to basal bone, then, if the musculature will permit, it should be just as logical to demand that the posterior teeth should also be so positioned. The part played by the musculature in stabilized corrected dentofacial deformity is one of the fascinating studies in the equilibirum requirements of acceptable dentofacial relationships.

Othodontists should be eternally grateful for men like Strang, Tweed, and others in the profession who are willing to analyze their treatment objectives and who, after so doing, are willing to change their attitudes and treatment methods if necessary in order to obtain desirable clinical results. Perhaps the logic of some of their assumptions and interpretations of research findings may be questioned. They themselves have acknowledged mistakes. Nevertheless, even though in certain respects they may be proved wrong, they have stirred the entire profession and, once again, have stimulated its members to re-examine the fundamental and basic concepts of the theory and practice of orthodontics.

SUMMARY

Treatment results obtained by one orthodontist cannot be completely appreciated by another unless their concept of the normal is identical.

Orthodontic results speak for themselves. It is the assumptions upon which the diagnosis and methods of treatment are based and the interpretations of what changes occurred to achieve the desired result that may be questioned.

Judicious extraction is permissible as a part of orthodontic treatment provided it is based on the actual rather than the assumed conditions of the case.

Those who teach orthodontics or contribute to its literature must constantly remember that they assume an enormous responsibility.

Research must be carefully executed and correctly interpreted or it can do more harm than good.

Students should be trained to analyze intelligently and to criticize constructively all that is said and written in the field of orthodontics and allied subjects.

When the subject matter is one in which the student or orthodontist has insufficient background, he should turn to one better prepared for his analysis and criticism.

There is a decided need for logic and consistent thinking in much of the orthodontic literature.

It is possible to prove almost any given thesis by quotations from the literature, but this does not substantiate its validity.

Change usually denotes progress, and it can in orthodontics, providing such change is based upon proved facts and not upon unreasoned and unreasonable assumptions.

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MIXED DENTITION CASE ANALYSIS—ESTIMATING SIZE OF UNERUPTED PERMANENT TEETH

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It is not enough for the orthodontist to be concerned only with the positions of teeth in the dental arch and their relationships with those of the opposite arch, for the anatomy of the individual teeth themselves plays an important part in orthodontic case analysis. A very fundamental aspect of tooth morphology is mesiodistal width; the importance of this factor to the orthodontist is obvious, since it is a measure of the size of the "building blocks" which he must build into a functional denture. In recent years, this phase of the orthodontic problem has been studied quantitatively by different investigators. Ballard[1] has shown that the dental arches are not the refined set of "gears" which some have thought them to be. He compared the mesiodistal widths of teeth of one side with those of corresponding teeth on the other side, and showed that in 90 per cent of the 500 cases examined, a discrepancy of a quarter of a millimeter or more could be found in one or more pairs of teeth, and that in 80 per cent of the cases this discrepancy amounted to half a millimeter or more. Without question, however, the real importance of the mesiodistal widths of teeth is in relation to the amount of room available for those teeth. Lack of harmony between tooth mass and the amount of supporting base is most commonly manifested in rotations and blocked-out teeth, conditions which may be conveniently lumped under the heading of deficiency of arch length. Clinical evidence lately adduced indicates that quantitative measurements may be profitably used in practice and applied at an earlier age than was heretofore thought possible.

Nance[2] has recently published a method of mixed dentition case analysis, wherein the amount of arch length available between the mesial of the mandibular first permanent molar and the distal of the mandibular permanent lateral incisor is compared with the total mesiodistal width of the permanent teeth which must occupy that space in the permanent dentition. The first measurement, the length between the permanent lateral incisor and first permanent molar is taken with dividers from the models of the mixed dentition. The second measurement, the amount of room necessary for teeth in the permanent dentition, is taken from intraoral x-rays. He describes his method in some detail and presents clinical evidence as to why measurements taken at this relatively early age may be validly used to estimate the child's prospects for having

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an evenly aligned mandibular dental arch, to determine indications for present and future therapy, and to establish the necessity for the extraction of permanent teeth in the permanent dentition. The ease and accuracy with which this sort of case analysis is accomplished is greatly affected by the quality of the x-rays available for the orthodontist's use. The accuracy with which the mesiodistal widths of unerupted teeth may be determined depends in large part upon the technique with which the films were taken, but even when these variables are reduced to a minimum, teeth may be rotated in their crypts so that a true measurement of mesiodistal width cannot be determined from intraoral or extraoral films even when they are beyond reproach.

The information provided in this report may be used as an adjunct to Nance's method of case analysis, or in any other situation which it is desirable to know the total mesiodistal width of unerupted canines and premolars.

MATERIAL AND PROCEDURES

Dentists have always assumed that there is some harmony in tooth size in one mouth, that is, if the incisors of a given individual are somewhat larger than the average, the canines premolars, and molars in that person will be correspondingly larger than the average for those teeth. If it can be demonstrated that there is this consistency of tooth size, practical use of the fact might be made by taking measurements of erupted teeth to arrive at an estimate of the size of teeth as yet unerupted. There are mathematical devices to indicate the degree of this consistency, and others which may be used as working formulas in making the estimate or prediction. In order to determine the extent of this consistency and to put it to use, the mesiodistal width of every mandibular tooth back to and including first permanent molars was obtained from plaster models by means of dividers and a millimeter rule, and recorded on a card for each of 441 individuals. No cases were included in the series unless all permanent incisors, canines, premolars and first molars were fully erupted, permitting accurate measurement. All models were made from plaster impressions. Measurements were read to the nearest one-quarter millimeter.

The sum of the four permanent mandibular incisors was determined for each individual, as was the sum of the canine, first premolar, and second premolar of one side. If there was found a discrepancy in mesiodistal width between right and left canines or premolars, a mean value was taken for the tooth in question. The mean sum of the four mandibular permanent incisors was 23.84 ± 0.08 millimeters. The mean sum of the canine, first premolar, and second premolar of one side was 21.97 ± 0.06 millimeters. The mean width of mandibular first permanent molars was found to be 11.20 ± 0.03 millimeters.

Still another value, the coefficient of correlation, must be calculated in order to determine, in a large group, the extent to which the sum of the canine, first premolar, and second premolar varies as the sum of the four incisors increases or decreases. The coefficient of correlation may vary from -1.0, which indicates a perfect inverse relationship between two variables ,to

+1.0, which indicates a perfect direct relationship between two variables. A coefficient of correlation of 0.0 indicates a completely chance relationship between the two variables in question.

The coefficient of correlation between the sum of the four mandibular incisors and the sum of the canine, first premolar, and second premolar of one side was found to be +0.64. This correlation is not particularly high, and is further testimony to the fact that the human denture is not the precisely designed machine that some would have it. However, other work showed that this correlation was sufficiently high that practical use might be made of it.

Once this coefficient of correlation has been determined, it is an easy matter to devise a formula whereby one may predict one of the variables when the other is known. This is the situation which we have in the mixed dentition, where the mandibular incisors and first permanent molars have erupted but where the mandibular canines and premolars are unerupted and therefore not susceptible to direct measurement of mesiodistal widths. The formula is as follows:

$$X = 9.41 + 0.527Y,$$

where X equals the sum of the canine, first premolars, and second premolars of one side of the mandibular arch, and Y equals the sum of the four mandibular incisors. In reality it is not necessary to make this calculation each time one seeks to determine the width of the three unerupted teeth in a mixed dentition case, since the device shown in Fig. 1 renders calculation unnecessary. One simply measures the four incisors (it is best to measure these teeth individually with dividers and prick the mesiodistal width of each tooth onto the same line of a lined card, so that the dividers may then be opend to make an accurate measurement of the sum of the four), determines the sum in millimeters by using an accurate rule, and finds this number on the left side of the scale in Fig. 1. Directly opposite, on the right side of the scale, will be found the sum of the three unerupted teeth which may be expected for that case. Obviously this value, derived as it is, is only an estimate of the sum of these teeth, the true sum of which can be determined only by direct measurement. It will be shown later how reliable this estimate is in the average case when compared with methods previously available.

Since mandibular first permanent molars are fully erupted by the time the four incisors are available for measurement, the first permanent molars may be measured in a mixed dentition case as well. It is conceivable that when the measurement of the first permanent molars is combined with the sum of the mandibular incisors for predictive purposes, a more accurate value for the three unerupted teeth would be obtained. In order to test this, two other coefficients of correlation were determined. The coefficient of correlation between the mesiodistal width of the first permanent molar and the sum of the canine and the premolars of one side was found to be +0.51. A coefficient of correlation between the mesiodistal width of the mandibular first permanent molar and the sum of the four mandibular incisors was found to

be +0.47. These values were then worked into a prediction formula, as follows:

$$X = 5.52 + 0.431Y + 0.552Z,$$

where X equals the sum of the canine and premolars of one side, Y equals the sum of the four mandibular incisors, and Z equals the mesiodistal width of one mandibular first molar.

The comparative value of the two predictive formulas was tested in a group of randomly selected cases wherein accurate measurments of the sum of the canine and premolars were available, and it was found that no significant improvement in prediction was afforded by using the more complicated procedure. Accordingly, no further consideration to the use of the mandibular first permanent molars for predictive purposes was given.

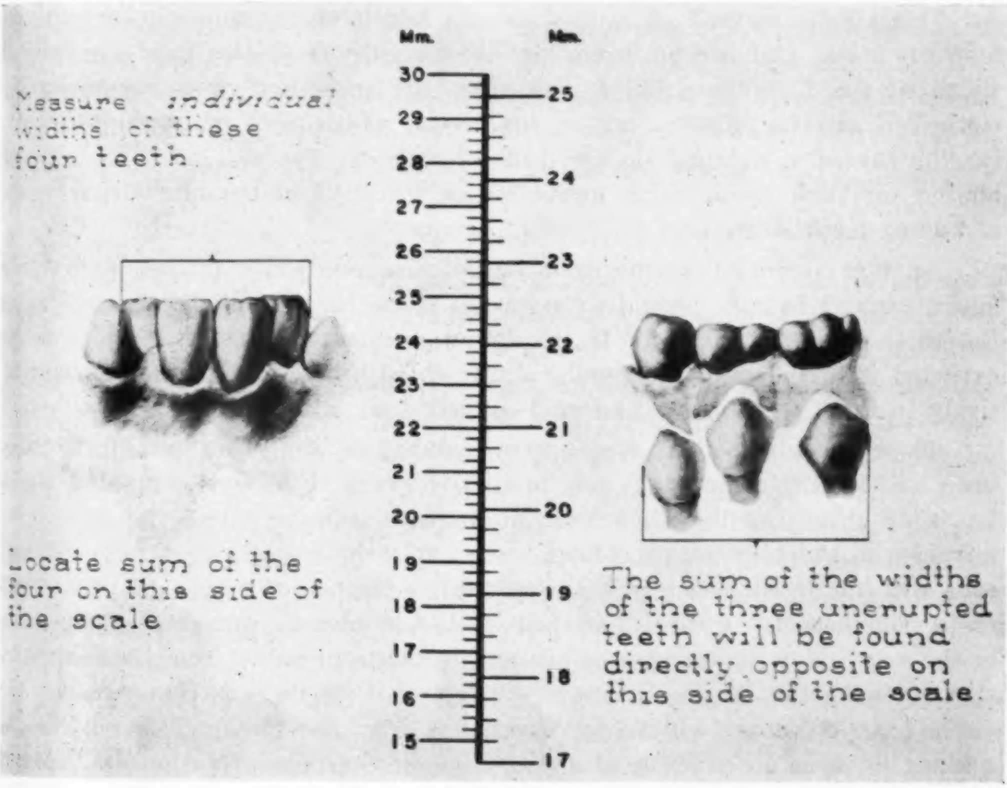

Fig. 1.

The next step was to determine the reliability of the predictive chart (Fig. 1) as compared with measurements taken from unerupted teeth in dental x-rays. Sixty determinations were taken as an adequate test. This was accomplished by measuring from dental x-rays the sum of the mesiodistal widths of unerupted canines, first and second premolars. In these cases, by using measurements of mandibular incisors taken from mixed dentition models which corresponded in time with the x-rays, the sum of the mesiodistal widths of the mandibular canines and premolars of one side was predicted from the chart

shown in Fig. 1. The accuracy of the measurements from mixed dentition x-rays and of the predicted value was checked by taking divider measurements from models of the same children after eruption of all the permanent teeth. The films used were intraoral films of average quality and quite comparable with those available to most orthodontists. The average error in the determination of the sum of these three teeth from x-rays was 10.5 per cent (2.2 millimeters). Although the amount of error varied from one case to another, the error was always in the direction of enlargement. The average error of the predictive graph was 2.6 per cent (0.6 millimeters). As might be expected, this mathematical device erred as often in the opposite direction as it did in the direction of enlargement.

DISCUSSION

This simple method of estimating the width of the mandibular canines, first premolar, and second premolar of one side from the total mesiodistal width of the four mandibular incisors is not presented as a superscientific method of arriving mysteriously at the precise width of three unerupted teeth. On the contrary, as much as anything this report shows the futility of ever hoping for such precision in prediction at least when the mesiodistal width of human teeth is involved.

Another possible misinterpretation of the predictive graph is that the figure derived from it provides "normal" value for the mesiodistal widths of the three teeth. The figure is simply an estimate of the total width to be expected if in the individual under study there is as much harmony quantitatively in tooth structure as is found in over four hundred individuals.

Those who have used Nance's procedures in analyzing mixed dentition cases will readily realize that this predictive graph, however accurate it might be, is no substitute for a good set of intraoral films. All of the qualitative purposes to which dental films have been put in the past should still be realized even with the introduction of this quantitative method of mixed dentition diagnosis. Furthermore, a careful analysis should involve measurement of the teeth in the x-rays, for the purpose of comparing the total value from the films with that given by the chart. In almost all cases, where there is disagreement, the value from the chart will be less than that from the films. This may be explained, at least in part, by size distortion in the films. If the disagreement is sufficiently large that it cannot be entirely explained on this basis, a value midway between the two may be accepted. If the value from the chart is larger than that given by the films, the latter should be used, but one should take this as evidence that disharmony in tooth size prevails in the mouth, with mesiodistal widths of mandibular incisors disproportionately great for the mandibular canine and premolars. While we were careful to point out that cases will be encountered where the predictive chart will not give true values, at the same time it should be remembered that the accuracy of the chart improves with harmony in tooth size between the two segments. Nance's work emphasizes the need for good intraoral films taken in the mixed dentition, and we

can only echo his wish that films of high quality might be more prevalently available for orthodontists than they are at the present time.

Dr. C. W. Carey of Palo Alto, California, did much to provide the incentive for developing this predictive graph. It was he who measured the mesiodistal widths of permanent teeth in a considerable number of models of his patients, in an effort to arrive at much the same result in cases where dental x-rays proved unsatisfactory. His method was to use an average value for the total mesiodistal width of the canine and premolars of one side when the sum of the four mandibular incisors fell within a certain range. We believe that our procedure is somewhat more satisfactory, since it is based on a larger number of cases and since it provides a specific value for the three unerupted teeth for every specific sum of the mandibular incisors, and therefore gives more flexibility. We should also like to acknowledge the cooperation of Dr. G. W. Hahn of Berkeley California, who gave us free access to his records so that we might take measurements from mixed dentition films in his files and from models of the permanent dentition taken at a later date on these same patients. Without his help it would have been difficult to compare the relative accuracy of routine dental x-rays with that of the predictive graph.

SUMMARY

1. The amount of harmony between groups of human mandibular teeth with respect to mesiodistal width is indicated by coefficients of correlation.

2. From the coefficients of correlation there has been derived a predictive graph which makes it possible for one, knowing the sum of the mesiodistal widths of the four mandibular incisors to arrive at the total sum of the mesiodistal widths of the mandibular canine, first premolar, and second premolar of one side.

3. The average error found to arise from the use of this predictive graph was 0.6 mm., or 2.6 per cent. In the same group of cases, using measurements taken from models of the permanent dentition as the correct values, the average error arising from the use of intraoral dental films of average quality taken in the mixed dentition was found to be 2.2 mm. or 10.5 per cent.

4. The predictive graph will give only the sum of the unerupted teeth of one side in the mixed dentition, and does not provide an estimate of the mesiodistal width of any one of the three teeth. As such it is offered as an adjunct to the method of the mixed dentition diagnosis and case analysis of Nance.

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CASE REPORT OF COMPLETE ANODONTIA OF THE PERMANENT TEETH

Morris Cramer, D.D.S., Baltimore, Md.

Many cases of partial anodontia have been in the literature, but complete congenital absence of the temporary or permanent teeth or both is rare.

Anodontia is divided into two large classes: partial and total or complete. Partial anodontia denotes the absence of one or more teeth either in the deciduous or permanent dentition, or in both. Total or complete anodontia means complete absence of the deciduous and the permanent dentition, or of either of them.

In the complete cases reported, many other abnormalities were found to be present, such as developmental disturbances of the hair all over the body, the absence of hair, lack of sweat glands, and the absence of the sense of smell or taste. In nearly every case so reported, heredity seemed to play a prominent part.

Guilford[1] cited the case of a 48-year-old man who was edentulous at birth, never perspired, had no sense of smell, and was almost devoid of taste.

Battersby[2] reported a case of complete absence of the deciduous and permanent teeth in a boy about 9 years of age, but he apparently could masticate his food well with his gums. His head was well covered with fine, light-colored hair. There was no evidence of rickets or any other disturbances. X-ray films showed complete absence of the teeth or rudiments of the teeth. There was a well-pronounced alveolar ridge, and the palate was flat, with marked rugae.

Nager[3] reported a case of complete anodontia in a 24-year-old man whose hair was very thin. He had a normally developed mandible and an undeveloped maxilla. He had no sweat glands, but was normal otherwise.

Werther and Rothenberg[4] reported a case of partial anodontia in a girl 15 years of age, who erupted only nine temporary teeth. The remaining eleven failed to develop. In the permanent set, only five teeth developed and erupted. Her history showed her to be a rather jumpy, nervous child, and slightly underweight. There was no evidence of rickets or other abnormalities, although there was a family history of the abnormality in the number of teeth.

Thoma and Allen[5] reported a case of a boy 5 years of age with complete anodontia. Physical examination revealed a blond boy with very dry skin, scanty, dry, brittle hair, and thin eyelashes. X-ray examination showed that no teeth were developing either in the mandible or the maxilla. Biopsy of the skin proved absence of hair follicles and sebaceous glands. Full dentures were constructed for him at the age of 6.

Brodie and Sarnot,[6] in their study of ectodermal dysplasia, claimed that complete congenital absence of teeth does not significantly impair the development of the face and jaws.

Cautley[7] reported the case of a young man aged 20 years, who had only deciduous teeth present. Both jaws were abnormal, the mandible especially so, being small, underdeveloped, and out of proportion to the rest of the face. His hair and sweat glands were quite normal. He had a brother and sister who were similarly affected. The mother and father and former generations as far as could be ascertained were unaffected.

Fig. 1.

Fig. 2.

Fig. 1.—Front view—edentulous.
Fig. 2.—Profile view—edentulous.

Ivy[8] reported a case of a young woman 28 years of age who had been wearing full upper and lower dentures since she was 16, but with considerable difficulty. X-ray examination revealed that her permanent teeth had developed and calcified in the jaws but failed to erupt in the oral cavity, A condition such as this could have been avoided if proper roentgenograms of the jaws were made at the time when the dentures were constructed.

Warr[9] published a report of complete anodontia of the permanent teeth of a boy 12 years of age who enjoyed good health and was normal in every respect except for dental deficiencies. His parents were first cousins, but

there was no history of any dental peculiarities on either side of the family as far as could be ascertained. Many of his deciduous teeth were still retained, although some were considerably worn. X-rays revealed complete absorption of the roots of the incisors, but the cuspids and molars showed no absorption. The boy's bite was very close. No permanent teeth were visible on x-ray examination. This case was treated prosthetically by raising the bite in stages with partial dentures.

Fig. 3.

Fig. 4.

Fig. 3.—Front view with old dentures.
Fig. 4.—Profile with old dentures, showing protruding lower jaw.

Case History.—Mrs. B. aged 23, was referred for new full upper and lower dentures. She had been wearing old vulcanite dentures since she was 13 years of age. At that time her mother became curious because there were no signs of any permanent teeth in either the upper or lower jaw, and only a few of the deciduous teeth remaining. She therefore consulted a dentist, who, upon thorough x-ray examination, discovered that there were no perma-

nent teeth either developing or erupting in either jaw. He extracted all the remaining deciduous teeth and constructed full upper and lower dentures. The patient stated that the dentist had a rather difficult time in extracting the molars. This was probably due to the fact that no resorption of these roots had taken place.

Fig. 5.

Fig. 6.

Fig. 5.—Front view with new dentures.
Fig. 6.—Profile view with new dentures, harmonious relation of both jaws.

The patient, one of seven children, six girls and one boy, has had no serious illness other than the usual childhood diseases. She was normally developed, weight about 120 pounds, height about 5 feet 5 inches, and gave a history of no other abnormalities. All her sisters and brother were dentally normal with the exception of an older sister, 33 years of age, who also had complete absence of the permanent teeth and who had been wearing two full dentures since she was 13 years of age. One other sister several years older erupted only twenty-four permanent teeth. As far as could be determined, Mrs. B's mother and father had no congenitally missing permanent teeth.

Examination.—Upon examination, it was noted that the maxilla and mandible were normally developed but rather small, showing a thin lower alveolar ridge. Complete x-rays were taken to determine if there were any

unerupted or undeveloped teeth. The roentgenograms disclosed a total absence.

The dentures that Mrs. B had been wearing for ten years had caused a slight protrusion of the lower jaw and a closure of the bite. In constructing the new dentures, it was necessary to open the bite about 2 mm. in order to bring the jaws in harmonious relationship. This made a very satisfactory change in her appearance.

Conclusion.—From cases reported in the literature, complete or partial anodontia seems to be largely influenced by heredity and to be accompanied in many instances by endocrine disturbances, such as abnormalities of the hair nails, and skin. Rickets, congenital syphilis, and faulty diet also have been advanced as causative factors of anodontia, but the exact etiology is still obscure. In the case here reported, while it was found that although another member of the family had complete anodontia and a second one had partial anodontia, there is no evidence, from the dental history of either of the parents or from any knowledge of the grandparents, that the congenital absence of the teeth was inherited.

The writer wishes to express his appreciation to Dr. Meyer Eggnatz for his cooperation and courtesy in taking all the photographs.

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2352 EUTAW PLACE

Department of Orthodontic Abstracts and Reviews

Edited by

DR. J. A. SALZMANN, NEW YORK CITY

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City

Vitamin A and Bone Growth: Reversibility of Vitamin A Deficiency Changes: By E. Mellanby, *J. Physiol.* **105**: 382, January, 1947.

Mellanby points out that a deficiency of vitamin A in the diet of growing animals causes widespread nerve degeneration. A cause of this degeneration was suggested when the examination of serial sections of the labyrinth and its capsule revealed that vitamin A deficiency results in a large bone hypertrophy which injures or destroys the nerve fibers and the cells of the spiral ganglion by pressing on the eighth nerve. The chief point of interest in this publication is the study of the reparative or recovery stage of bone growth, especially of the cranial bones, when vitamin A is restored to an animal after a period of deficiency. The addition of vitamin A to the diet of an A-deficient animal during growth brings about a return of osteoclastic and osteoblastic activity to the surfaces where it is normally found. Although vitamin A deficiency causes a general thickening and dysplasia of bone by its effect on osteoclasts and osteoblasts, the method of producing this abnormal state varies, as is shown in the three regions discussed, namely, the basioccipital, the periosteal bone covering the labyrinth, and the sphenoid bone in relation to the optic foramen. The recovery changes on adding vitamin A are also different in different cases. The altered shape of bones adjacent to the nervous system may destroy cranial and spinal nerves and exert other harmful effects, but the recovery changes in dysplastic bone on the addition of vitamin A to the diet take place independently of the condition of the adjacent nerve or nervous tissue.

Recurrent Dislocation of the Mandible: *J. A. M. A.* **133**: 74, January 4, 1947.

To the Editor.—A patient has had thirty or forty dislocations of the mandible in the past year and a half following a difficult tooth extraction. The dentist had to force the mouth open vigorously. The jaw went out of place and apparently the capsule was so stretched that the dislocation has been recurring. Recently, general anesthesia has been necessary for reduction because of severe pain. Has the method of injecting a sclerosing solution into the capsular ligaments to produce contraction been successful? What type of solution has been most successful and what is the technique?

Answer.—In recurrent dislocation (or subluxation) of the mandible, simple treatment should be instituted early. After the second dislocation of the mandible, interdental wiring (or elastics), a chin strap, or other device to limit the opening of the mouth should be applied for several months. If this procedure proves to be inadequate, as it frequently does, the temporomandibular joint should be injected with a sclerosing solution. The results have been encouraging. The technique briefly is as follows: With the mouth open, a

1.5 inch long 26-gauge needle on a 1 c.c. tuberculin syringe is inserted into the temporomandibular joint posterior to the head of the condyle in a slightly upward and inward direction until contact is made with the mesial wall of the glenoid fossa. The penetration of the needle will be 2 to 3 centimeters. The needle is withdrawn about 0.5 cm., and 0.25 to 0.5 c.c. of a 5 per cent aqueous solution of sodium psylliate mixed with an equal portion of 2 per cent procaine hydrochloride is injected. Sometimes several injections about ten days apart are necessary. The following references discuss the injection and surgical treatment of this disorder:

Schultz, L. W., and Shriner, Walter: Treatment of Acute and Chronic Traumatic Temporomandibular Arthritis, J. Florida M. A. **30**: 189, 1943.

Burman, Michael, and Sinberg, S. E.: Condylar Movement in the Study of Internal Derangement of the Temporomandibular Joint, J. Bone & Joint Surg. **28**: 351, 1946.

Currents in Biochemical Research: Edited by David E. Green. 31 essays charting the present course of biochemical research and considering the intimate relationship of biochemical to medical agriculture and social problems. Price, $6.00. Interscience Publishers, Inc., New York, 1946.

"There is an acute need," says the author, "for stripping complex subjects and getting at the simple, essential concepts which are basic to their appreciation." *Currents in Biochemical Research* is an attempt of some thirty research workers to describe, in as simple language as possible, the important development in their own fields and to make correlative observations on the most likely path of future progress. Among the suggestions dealt with are pharmacology, chemotherapy, public health, genetics, and others. The focal position of biochemical reesarch in biology, chemistry, and medicine is emphasized.

A discussion is presented of genetically determined reactions in the metabolic processes of the body. Evidence is presented on the similarity of genes and viruses and on the chemical nature of genes. Direct chemical analysis of whole chromosomes showed them to be largely nucleoprotein. An interesting chapter entitled "Social Aspects of Nutrition" is presented by W. H. Sebrell, Medical Director, United States Public Health Service, Chief, Division of Physiology, National Institute of Health. It is pointed out here that present knowledge is adequate to insure the provision of healthful food for human need. The problem now is how the food can be made available to low income families, since the next great step forward must be a general recognition that the future development of the nation, the maximum of health and prosperity, depends on adequate nutrition for everyone.

The Relationship of Dental Malocclusion to Vacuum-Otitis Media and the Use of Dental Splints During Descent From Altitudes: By Howard R. Bierman, Commander, Medical Corps, United States Naval Reserve, Bethesda, Maryland, and I. William Brickman, Lieutenant, Dental Corps, United States Naval Reserve, Pensacola, Florida, *Ann. Otol., Rhin. & Laryng.* **55**: 5-12, March, 1946.

In the low pressure chambers at the Naval Air Station, Pensacola, Florida, examinations showed that from 10 to 15 per cent of more than 15,000 men developed ear block during recompression. Ear block may be defined as discomfort in or about the ear of sufficient degree during recompression to require halting any further increase of pressure.

Ear block during low pressure chamber descents was found to occur about five times as frequently in individuals with malocclusion as in individuals with normal occlusion. This fact suggested that respositioning the mandible might have a beneficial effect in those individuals with malocclusion. This was supported by the finding that voluntary repositioning of the jaw (yawning) proved to be the most effective method in middle ear ventilation on descents.

Horseshoe-shaped dental splints were made of acrylic resin. The intermaxillary distance was increased 8 mm. along the biting surfaces and the width was 12 mm. The splint was retained in the mouth during the entire period of descent. The rate of descent was approximately 5,000 feet per minute. The splints were inserted at 30,000 feet.

The dental splints significantly reduced the incidence of ear block only in individuals with malocclusion.

Overclosure or malposition of the jaw enhances this compression and also shortens the span of the tensor veli palatini muscle from its origin at the membranous part of the auditory tube to its insertion in the soft palate, and impairs the efficiency of this muscle in opening the auditory tube during swallowing. Thus, in malposition of the jaw, there is not only compression of the auditory tube by the external pterygoid, but the usual efficiency of the mechanism of opening the tube by swallowing is impaired.

The simplest method for ventilating the middle ear is swallowing. In certain individuals, however, swallowing is ineffective and the individual requires the aid of other maneuvers or a combination of maneuvers to obtain satisfactory middle ear ventilation. Excessive mandibular movement, on the other hand, although most effective, changes the normal contour of the face, thus altering the fit of an oxygen mask and increasing the opportunity for leakage of atmospheric air. An attempt to combine deglutition with a simultaneous downward and forward movement of the jaw has proved a difficult maneuver to learn for mass instruction.

Ventilation of the middle ear for passengers can be readily and safely obtained without the modified Valsalva maneuver. Merely swallowing with the nares held closed is sufficient to allow air to pass into the middle ear.

The effectiveness of the dental appliance appears to be mainly in increasing the intermaxillary distance. The increase in salivation caused by the splint stimulates swallowing, which undoubtedly assists in the ventilation of the middle ear. This device also has been developed to fit all types of occlusion and is suitable for passenger use in transport aircraft.

News and Notes

Meeting of American Association of Orthodontists, April 27, 28, and 29, 1948

Each member received a letter dated September 12 requesting him to make a reservation for the American Association of Orthodontists meeting which is being held in Columbus, Ohio, April 25 to 29, 1948, inclusive.

The Neil House and Deshler-Wallick Hotels have informed me that over 50 per cent of the available rooms have already been reserved.

Those of you who have not made a reservation should do so at once.

Deshler-Wallick Hotel

Neil House

The Program Committee has developed a splendid scientific program around "The Passage of a Patient Through an Orthodontist's Office," which should be useful material for every member of the American Association.

Diversified entertainment is being arranged for the ladies. The annual golf tournament will be held at the Columbus Country Club, which has become nationally known by entertaining such distinguished guests as Byron Nelson, who won the 1946 Columbus Open, and Mr. Gordon Locke, who won the event in 1947. A stag banquet will be held at the Columbus Country Club following the golf tournament on Monday evening, April 26. More about these events will be published later.

Please make your reservations immediately.

FRED'K R. ALDRICH

Northeastern Society of Orthodontists

The next meeting of the Northeastern Society of Orthodontists (formerly New York Society of Orthodontists) will be held at the Waldorf-Astoria Hotel, New York, on Monday and Tuesday, Nov. 10 and 11, 1947.

Southwestern Society of Orthodontists

The Southwestern Society of Orthodontists will hold its annual meeting Feb. 1, 2, 3, and 4, 1948, at the Broadview Hotel, Wichita, Kansas.

The speakers will be Dr. Alexander Sved of New York City, Dr. Clint Howard, now of Oakley, South Carolina, Dr. George Nagamoto of Kansas City, Dr. Martin F. Palmer of Wichita, Kansas. Case reports will be given by Dr. Dan Peavy of San Antonio, Texas.

American Academy of Dental Medicine

The American Academy of Dental Medicine will hold a luncheon meeting, prior to the Greater New York Dental Meeting, at the Hotel Pennsylvania on *Sunday, December 7, 1947,* at 12:30 P.M. Round-table discussion will follow. All members and interested dentists and physicians are invited to attend.

At a recent meeting, the following officers were elected for the year 1947-1948: Dr. Sidney Sorrin, President; Dr. J. Lewis Blass, President-Elect; Dr. William M. Greenhut, Secretary; Dr. George A. Bruns, Treasurer; Dr. Allan N. Arvins, Editor.

Address all communications to Dr. William M. Greenhut, Secretary, 124 East Eighty-fourth Street, New York City.

Cuban Association of Orthodontists

It has been announced that the Asociacion de Ortodoncistas de Cuba will give a course in orthodontics in the Orthodontics Department of the University of Havana during December, 1947, under the direction of Dr. Charles Tweed of Tucson, Arizona.

Notes of Interest

Edward Cherkas, D.D.S., announces the opening of his office at 1208 Medical Arts Building, 16th and Walnut Streets, Philadelphia, Pennsylvania, practice limited to orthodontics.

Harold H. Gilbert, D.D.S., wishes to announce the removal of his offices to 2359 Eutaw Place, Baltimore 17, Maryland, practice limited to orthodontics.

Dr. Charles F. Mitchell wishes to announce the opening of his office, for the exclusive practice of orthodontics, at 6453 Whittier Boulevard, Los Angeles 22, California.

Joe Tennyson Reece, D.D.S., Orthodontist, wishes to announce the opening of his office at 1520 South Lewis, Tulsa, Oklahoma.

Homer B. Robison, D.D.S., is pleased to announce that Leo A. Rogers, D.D.S., will be associated with him in the practice of orthodontics at 618-619 Wiley Building, Hutchinson, Kansas.

Fay C. Van, D.D.S., announces the opening of his office for the practice of orthodontics at 1245 Glendon Avenue, Suite 39, Westwood-Wilshire Professional Building, Westwood 24, California.

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The AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY is the official publication of the American Association of Orthodontists and the following component societies. The editorial board of the AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY is composed of a representative of each one of the component societies of the American Association of Orthodontists.

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In the January issue each year, the AMERICAN JOURNAL OF ORTHODONTICS AND ORAL SURGERY will publish a list of all of the orthodontic societies in the world of which it has any record. In addition to this, it will publish the names and addresses of the officers of such societies.